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Important contributions to geographic science are constantly being made through expeditions financed by funds set aside from the Society's income. For example, immediately after the terrific eruption of the world's largest crater, Mt. Katmai, in Alaska, a National Geographic Society expedition was sent to make observations of this remarkable phenomenon. So important was the completion of this work considered that four expeditions have followed and the extraordinary scientific data resultant given to the world. In this vicinity an eighth wonder of the world was discovered and explored—"The Valley of Ten Thousand Smokes," a vast area of steaming, spouting fissures, evidently formed by nature as a huge safety-valve for erupting Katmai. By proclamation of the President of the United States, this area has been created a National Monument. The Society organized and supported a large party, which made a three-year study of Alaskan glacial fields, the most remarkable in existence. At an expense of over $50,000 it has sent a notable series of expeditions into Peru to investigate the traces of the Inca race. The discoveries of these expedition form a large share of the world's knowledge of a civilization which was waning when Pizarro first set foot in Peru. Trained geologists were sent to Mt. Pelee, La Soufriere, and Messina following the eruptions and earthquakes. The Society also had the honor of subscribing a substantial sum to the historic expedition of Admiral Peary, who discovered the North Pole April 6, 1909. Not long ago the Society granted $20,000 to the Federal Government when the congressional appropriation for the purchase was insufficient, and the finest of the giant sequoia trees of California were thereby saved for the American people and incorporated into a National Park.

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1899—1920

As the Locomobile enters its twenty-first season of activity, it seems appropriate and desirable to make an expression of appreciation to the many admirers and supporters of our unusual policies.

The Locomobile as is well known, is conceded the foremost position among motor cars. Abroad as well as at home, the reputation of the car is of the highest; and if a specific illustration were needed, the selection of the Locomobile as the car for General Pershing to use officially in France, is sufficient to express the esteem in which the car is held.

Every one knows also that the great prestige of the Locomobile was built up by years of constant adherence to the most elevated standards of design and workmanship. And every one further understands that extraordinary extremes of care and painstaking have been gone to in the Locomobile Works, so as to make each car superior in detail.

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The present model will be continued. There will be no radical changes. The Locomobile policy is thus re-affirmed; and the car will go on to greater and greater triumphs in its own peculiar and special field.

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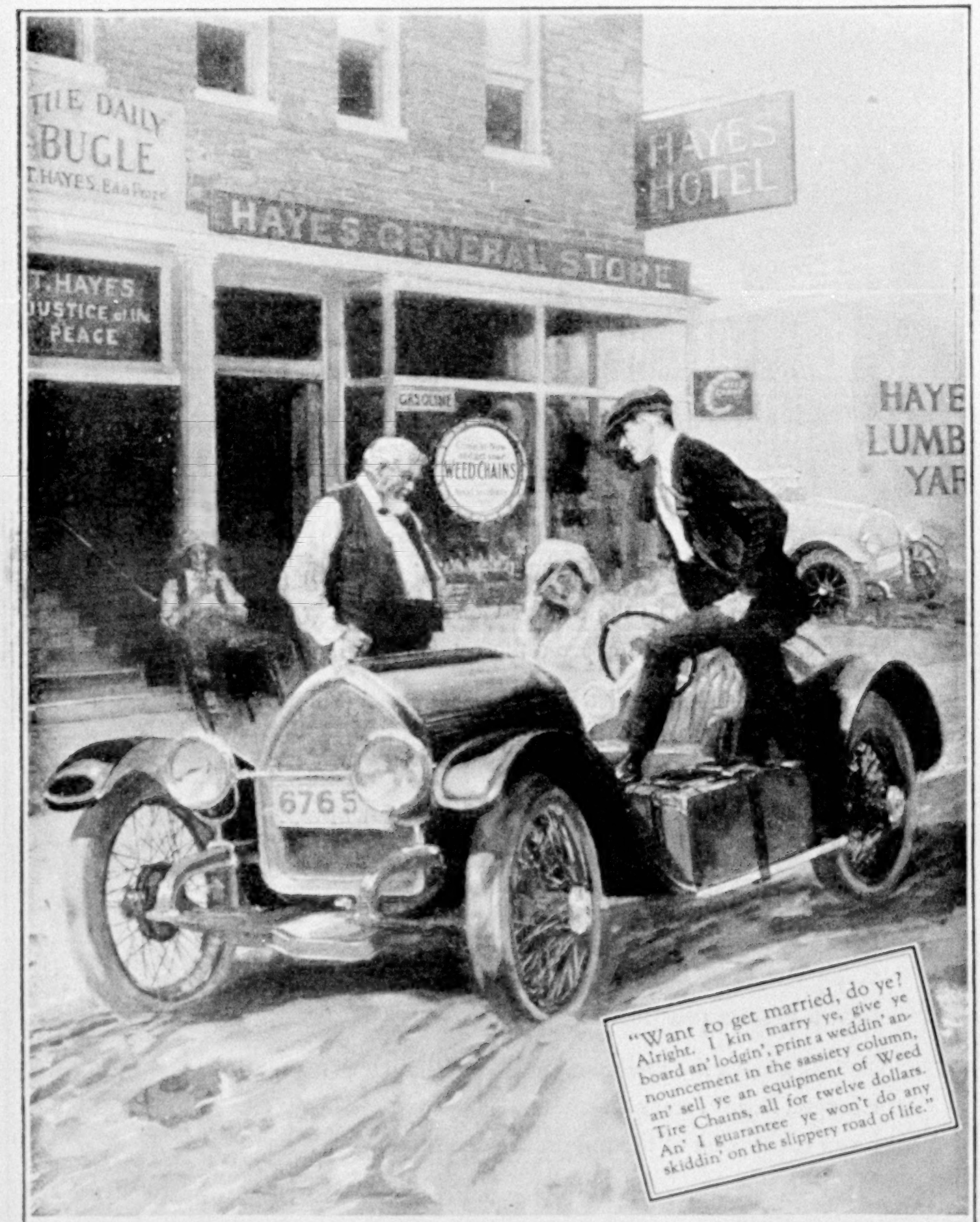
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Who Dictates the Changes in Motor Car Design

EVERY now and then it occurs to some one to ask, "What happens to all the old Packards? Not those of eight or ten years ago, now running as taxicabs, but the in-between models—'15 and '16 and along there?"

A perfectly natural question, considering how accustomed people are to perpetual change in motor car design.

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The Packard Company believes that design is fundamental when it is governed by established standards of good taste and engineering, and not by passing fancies.

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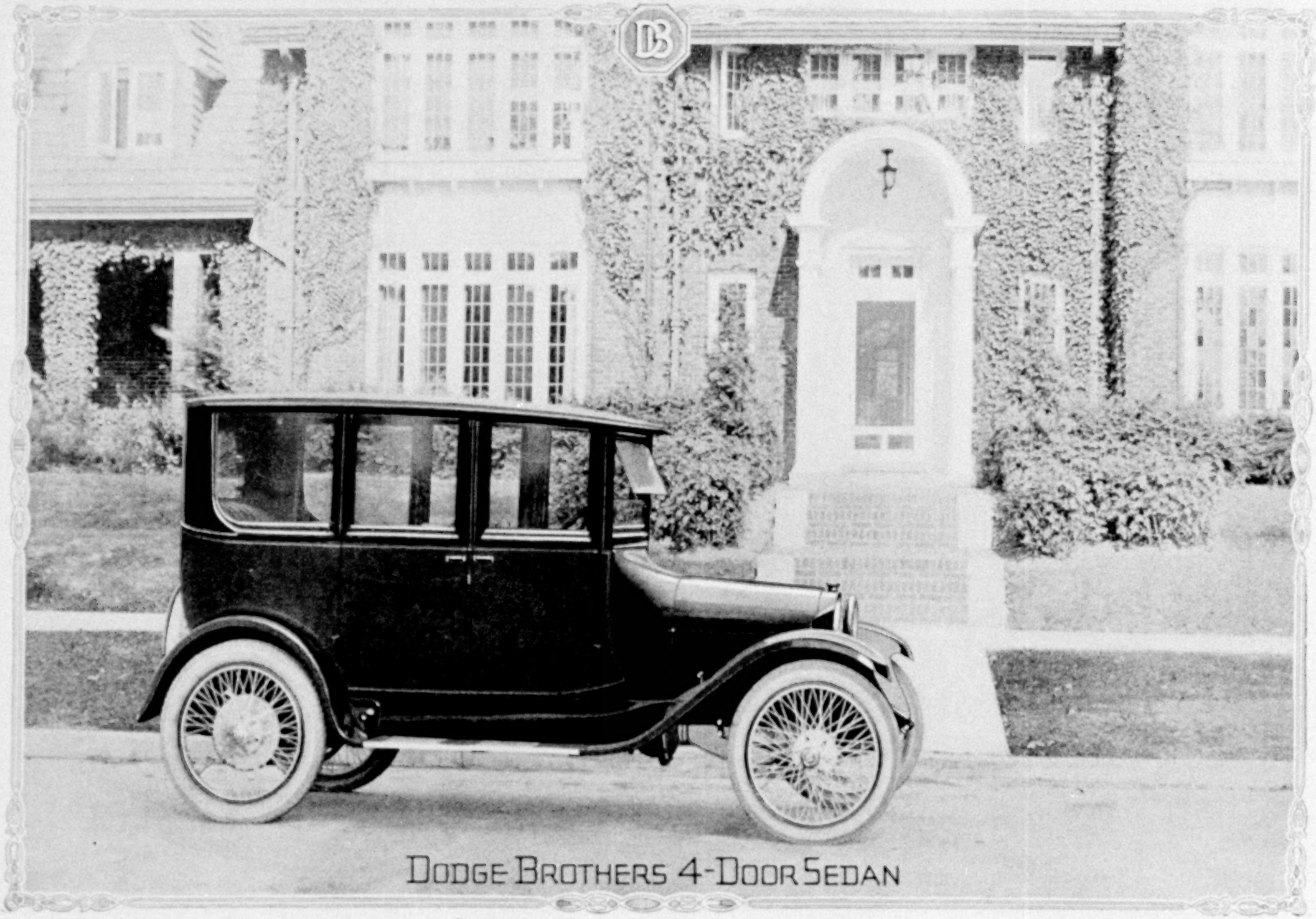
THE Packard car is designed to last as long as fine workmanship, sound engineering and the highest grade of materials can make it.

And that is why Packards are always "new models."

And why the Packard owner's investment never suffers from sudden changes of "fashion," dictated by some one over whom he has no control.

"Ask the Man Who Owns One"

PACKARD MOTOR CAR COMPANY, *Detroit*



DODGE BROTHERS 4-DOOR SEDAN

When Wide Awake

In the morning Puffed Rice or Corn Puffs. Serve with cream and sugar, with melted butter or mixed with any fruit.

They are food confections—bubble grains—with a taste like toasted nuts. No cereal foods were ever so delicious.

Serve them often—not on gala mornings only. They are not mere tidbits—they are scientific foods.

When children love these Puffed Grains as they do, let them revel in them.

Girls also like to use them as nut meats in their candies and as garnish on ice cream.

When Sleepy

At night serve Puffed Wheat in a bowl of milk. These are whole-wheat bubbles, flimsy, flaky, puffed to eight times normal size.

Every food cell is exploded by Prof. Anderson's process, so digestion is easy and complete.

This is the perfect good-night dish. It supplies whole-wheat nutrition. It does not tax the stomach. With milk it makes the greatest dish that you can serve to children.

In addition to all this, Puffed Grains are also the most fascinating cereal foods known.

Like Pancakes made with nuts

Now we are making a pan-cake flour mixed with ground Puffed Rice. The Puffed Rice Flour makes the pancakes fluffy and it gives a nutty taste. Never were pancakes so delicious as you can make with Puffed Rice Pancake Flour. Try it. The flour is self-raising.

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Puffed Rice

Corn Puffs

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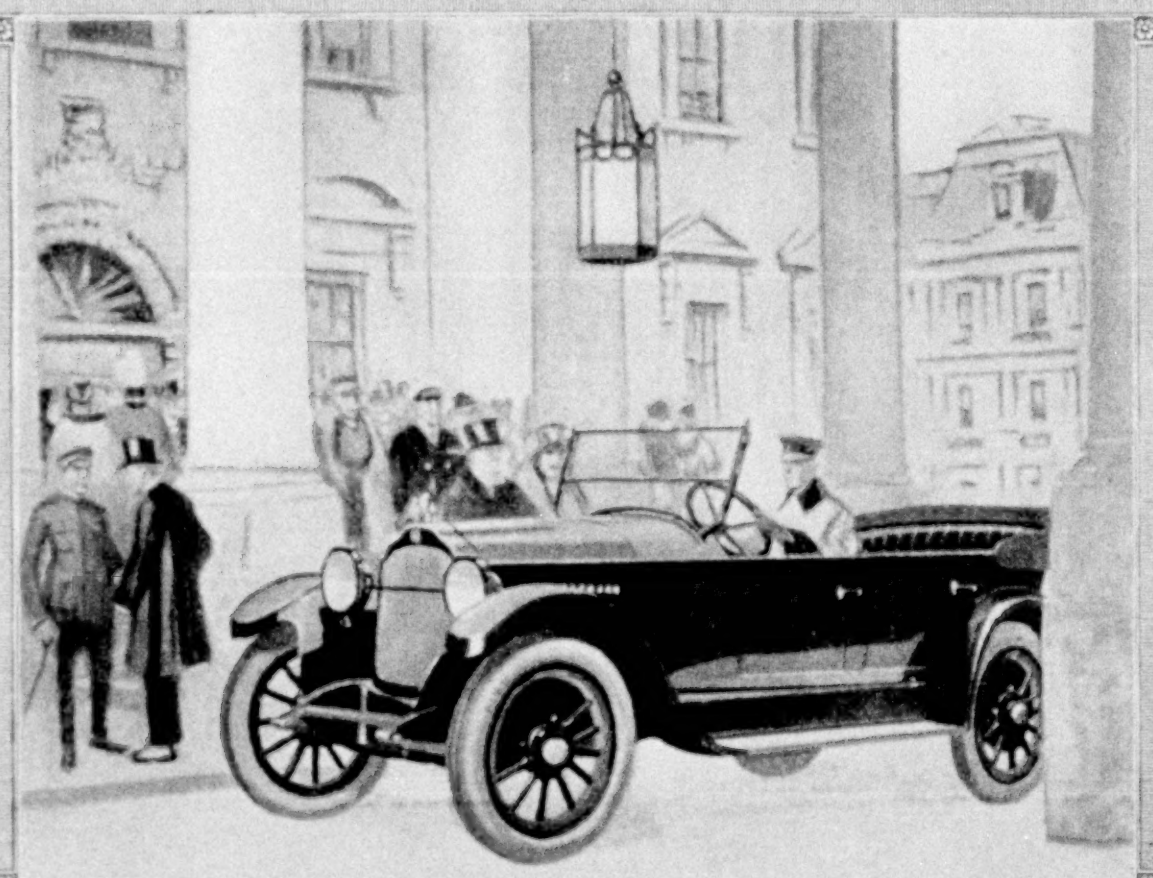

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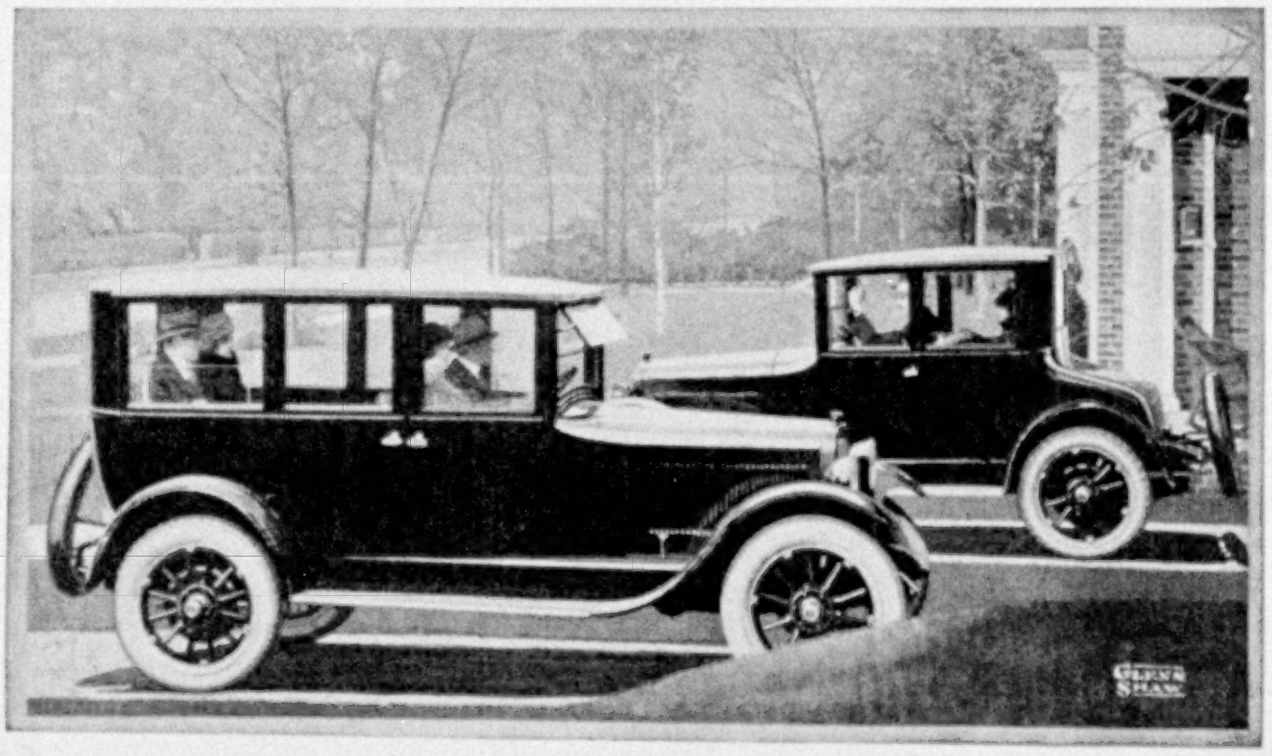

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YOU may laugh at the rains and the snows and the winds,— if you have a Chandler Sedan or Coupe.

In fair weather or foul, there are no more pleasing cars than these two. Both are of handsome lines and finish, luxuriously upholstered and uncommonly restful in the comfort of their cushions. The sedan seats seven persons, when the auxiliary chairs are used, and the coupe seats four.

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How to Soften Your Beard

Yet Avoid Slow, Harsh Ways

The Facts About Shavaid

To men who find shaving exasperating, we offer here a new freedom. A better, quicker, simpler way which, once tried, you will never abandon. And we back our statements with a Free Trial Tube, so that you may be completely convinced. The coupon brings it.

THIS is to urge you to try—for your own sake—a new shaving method. A way which has already won the friendship of thousands of men the country over.

Your trial of Shavaid, we promise, will be a revelation. For most men have come to the conclusion that shaving would always be a task.

Read here what Shavaid does; then—if these things appeal to you—let actual proof decide whether you can be content with the old tedious way.

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Merely apply a thin coat of cooling Shavaid to the dry face. Then the lather which needs no rubbing in. Then shave with real comfort.

No need to copy the barber's preparations. He uses hot water, hot towels. He rubs the lather in. Yet, when he is through, there is irritation. So he applies lotions.

Harsh, harmful ways of treating the face should be avoided. They age the skin. Wrinkles come too early. The skin becomes leathery.

The Shavaid way is the comfort way. It is scientific, the result of countless experiments and tests.

Shavaid

Softens the beard instantly
—apply to dry face before the lather.

Saves time and trouble
—no hot water, no "rubbing in" of the lather.

Protects the face
—skin remains firm and smooth.

Removes the razor "pull"
—harsh ways age the skin prematurely.

Replaces after-lotions
—Shavaid is a cooling, soothing balm.

More Than a Time Saver

Shavaid, of course, appeals chiefly because it saves time. But it does more than that—it saves the skin. While softening the beard instantly, it also forms a protecting layer over the cuticle. The skin remains firm and smooth.

The razor glides over without pulling, without scraping the skin. Abrasions are not so frequent.

The closest shave causes no discomfort.

When you use Shavaid, you can discard the after-lotions, for the sources of mistreatment are gone.

Try This Luxury Shaving Method

The coupon below brings you a Free Trial Tube. Send for it now. Then see if you want to adopt Shavaid.

We are sure it will delight you, amaze you, and that you will never shave again without it.

And you will tell your friends of this better way.

Shavaid, only recently introduced nationally, brought orders from dealers everywhere. Get it at your nearest druggist for 50c a tube.

If your dealer cannot supply Shavaid we will be pleased to fill your order direct.

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Shavaid

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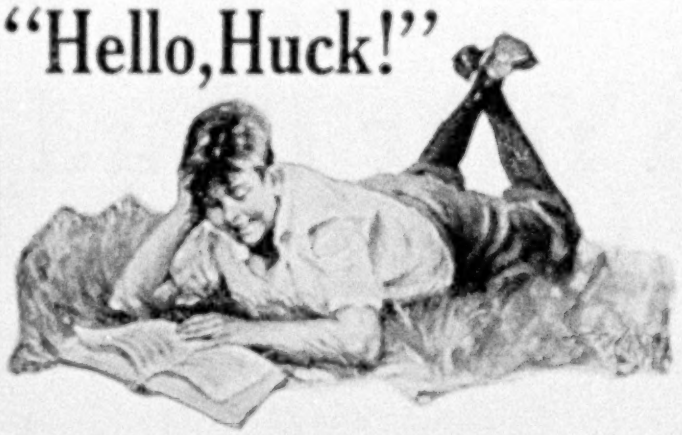
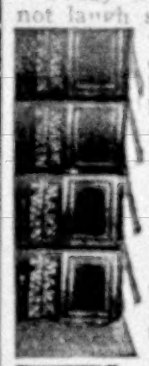


RECALL that golden day when you first read "Huck Finn"? How your mother said, "For goodness' sake, stop laughing aloud over that book. You sound so silly." But you couldn't stop laughing.

Today when you read "Huckleberry Finn" you will not laugh so much. You will chuckle often, but you will also want to weep. The deep humanity of it—the pathos, that you never saw as a boy, will appeal to you now. You were too busy laughing to notice the limpid purity of the master's style.



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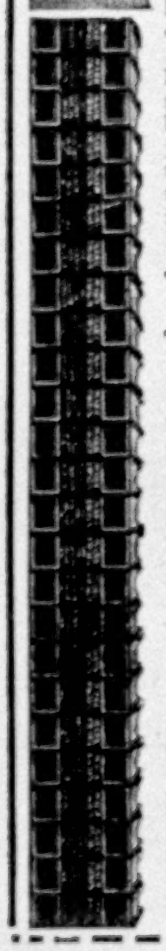
Perhaps you think you have read a good deal of Mark Twain. Are you sure? Have you read all the novels? Have you read all the short stories? Have you read all the brilliant fighting essays?—all the humorous ones and the historical ones?



Think of it—25 volumes filled with the laughter and the tears and the fighting that made Mark Twain so wonderful. He was a bountiful giver of joy and humor. He was yet much more, for, while he laughed with the world, his lonely spirit struggled with the sadness of human life, and sought to find the key. Beneath the laughter is a big human soul, a big philosopher.

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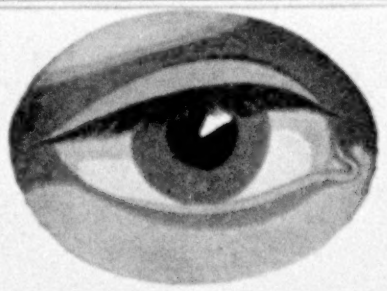

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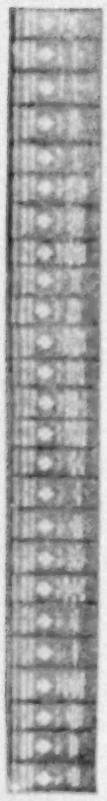

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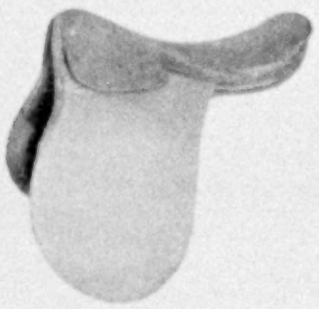

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It was not speed that gave it sales leadership; though Hudson holds more stock-car speed records than any car, and with cars embodying the Super-Six principle won more points in speedway racing than the fastest special racers ever built.

It was not power; though Hudson holds the fastest time ever made up Pike's Peak, in the classic of all hill climbs.

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They are valued of course by more than 80,000 Hudson owners. They contribute to the rounded supremacy of performance which distinguishes the Hudson everywhere. And it is natural to feel pride of ownership and affection for a car that none can rival in fleetness, or in hill-climbing.

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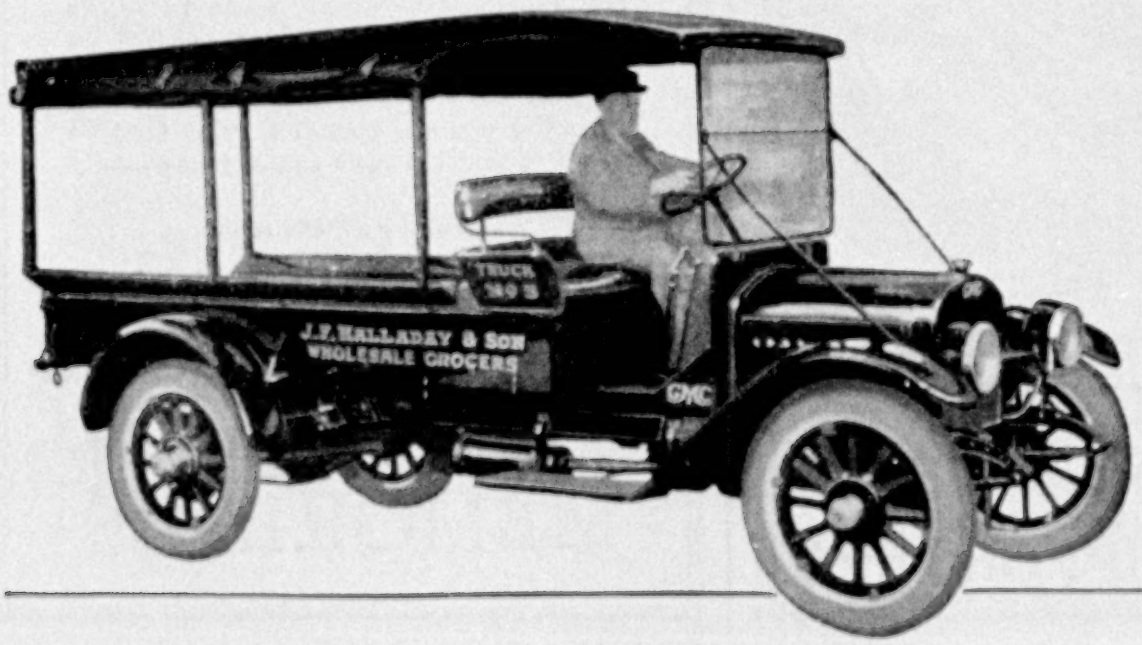

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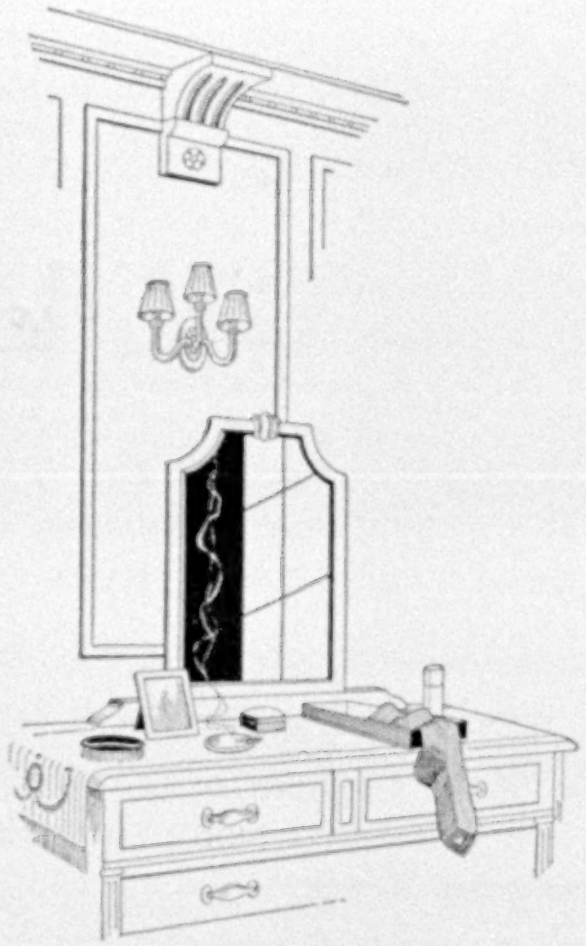

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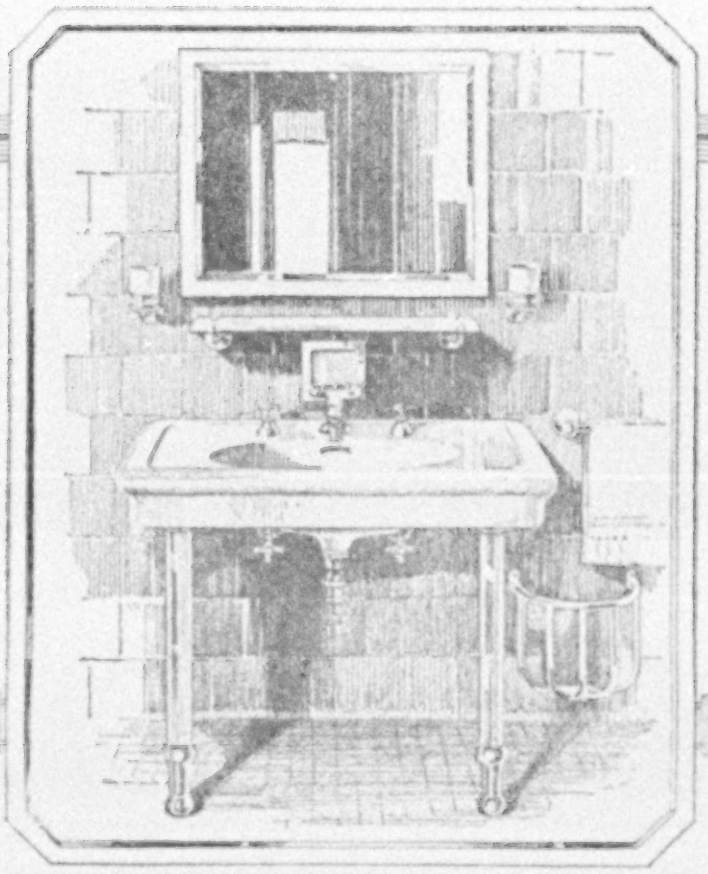

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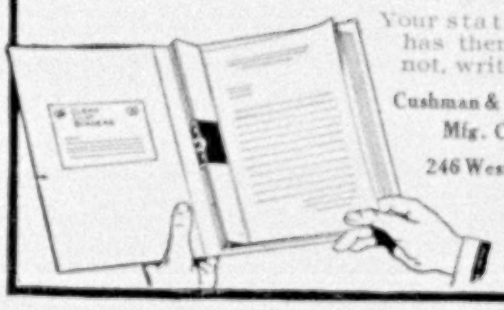

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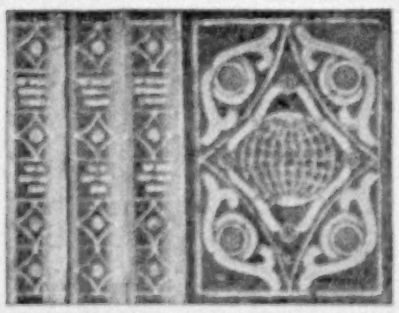

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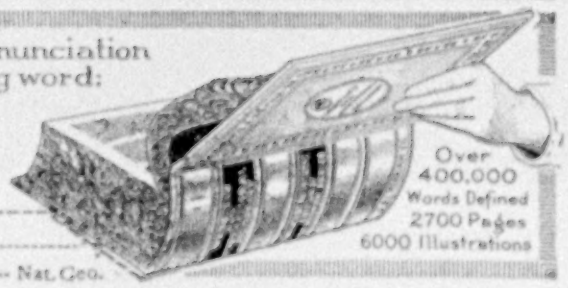

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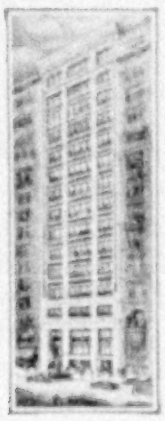

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VOL. XXXVII, No. 3 WASHINGTON MARCH, 1920

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MASSACHUSETTS—BEEHIVE OF BUSINESS

By William Joseph Showalter

LILLIPUT in area, Brobdingnag in industry; forced to get its bread elsewhere, but helping to clothe nations; longest American, except Virginia, in the span of its history, yet least American, except Rhode Island and the Canada-bordering States of the Mississippi Valley, in the ancestral stock of its present inhabitants; losing half of its improved farm lands in thirty years, while doubling its population—Massachusetts rewards the investigator of its twentieth century status with many contrasts and not a few paradoxes.

Everybody knows that the Bay State is one of the smallest of the Commonwealths that compose the United States of America, but who realizes that it takes as many Massachusetts to make a United States as it takes days to make a leap year? Or who appreciates the fact that in area there are as many Bay States in California as there are holes in a full golf course.

A GIANT IN ALL SAVE SIZE

The crow needs to fly only 135 miles in going from Sheffield to Salisbury, or only 180 miles in winging its way from Greylock's summit to Chatham's sands, while the distance between Lake Monomonac, which spans the New Hampshire boundary, and Lake Chaugogagogmanchaugagogchaubunagungamaug, which touches Connecticut, is only a little longer than the name of the latter.

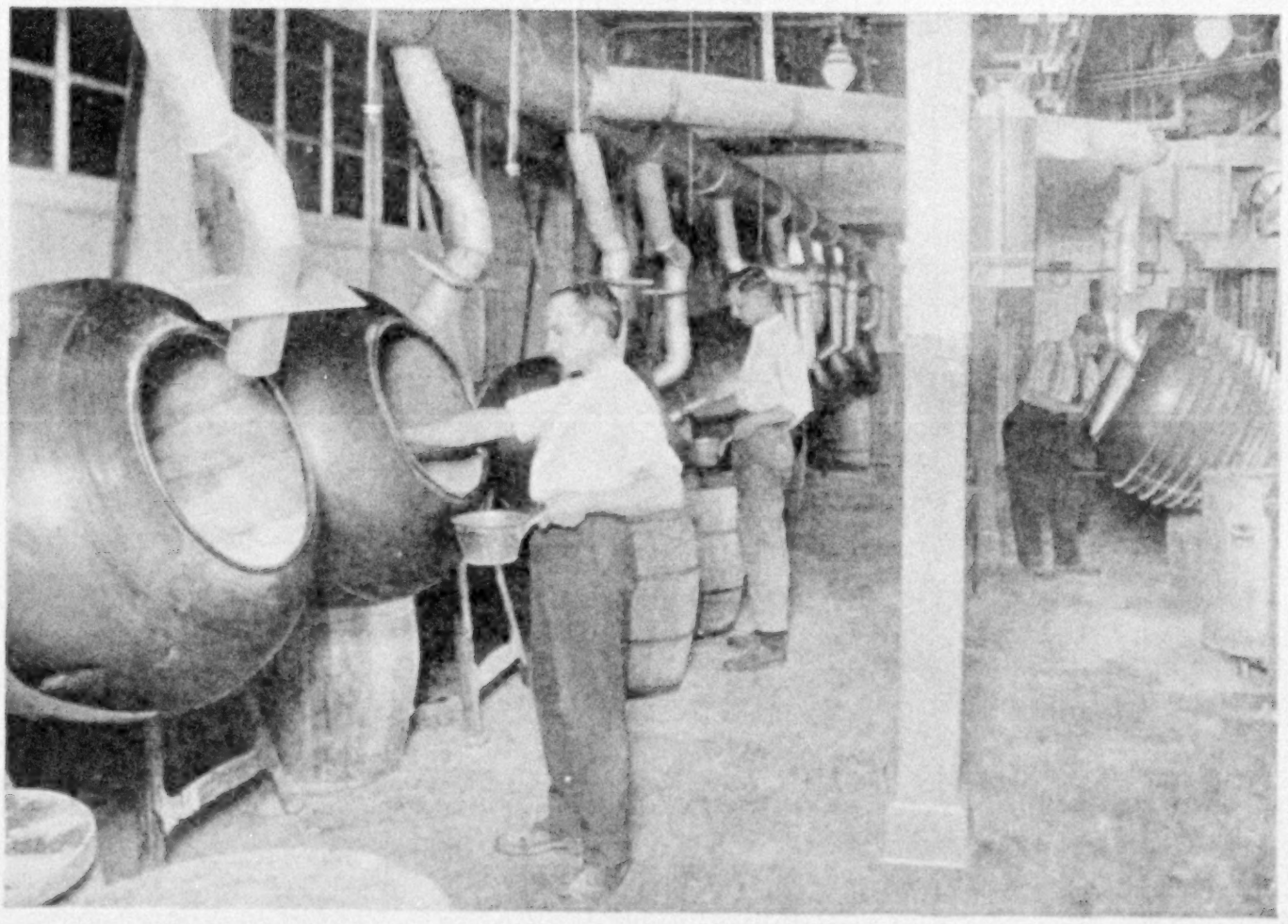
But this midget in domain is a giant in power. Measured by the products of its factories, by its financial contributions to the Federal Government, it occupies fifth place in the sisterhood; measured by the money it annually appropriates for its own betterment, it attains fourth place from the top, and is a lively disputant with Illinois for third; measured by the debt it has dared to incur in order to promote the welfare of its people, it takes second place, despite the fact that there are seven States that surpass it in wealth.

This year Plymouth, Massachusetts, plans to entertain the country in honor of the 300 years that will have passed since New England was born. There are citizens in the Bay State who have ten generations or more of American blood in their veins. Yet two-thirds of the people of the Commonwealth have sprung from parents one or both of whom were born under alien flags.

Where Paul Revere lived in Revolutionary times is now Little Italy, almost as foreign in the tongue spoken as Naples or Genoa. With only a third of the State's population born of parents who first saw the light in America, how small must be the percentage born of full colonial lineage!

But is Massachusetts less American for its tremendous foreign stock? Look at the recruiting records—holding sixth place in population, but fifth in voluntary enlistments for the World War. Look at the Liberty Loan records—third place in the first and second loans and fourth place in the other three.

XUM



Photograph by Leon H. Abdalian

THE PILL-COATING ROOM OF A MASSACHUSETTS DRUG COMPANY

As these huge containers revolve they sugar-coat pills at the rate of 12,000,000 in 24 hours.

Eight people out of nine in Fall River may have foreign blood in their veins, but Fall River never failed to go over the top with every drive. Seven out of eight of the inhabitants of Lawrence, where the paper for THE GEOGRAPHIC MAGAZINE is made (see also pages 234-238), may have grandparents born under alien flags, but in the Third Liberty Loan drive only six of the major cities of the United States showed a greater proportion of subscribers.

MANUFACTURES THRIVE AT THE EXPENSE OF AGRICULTURE

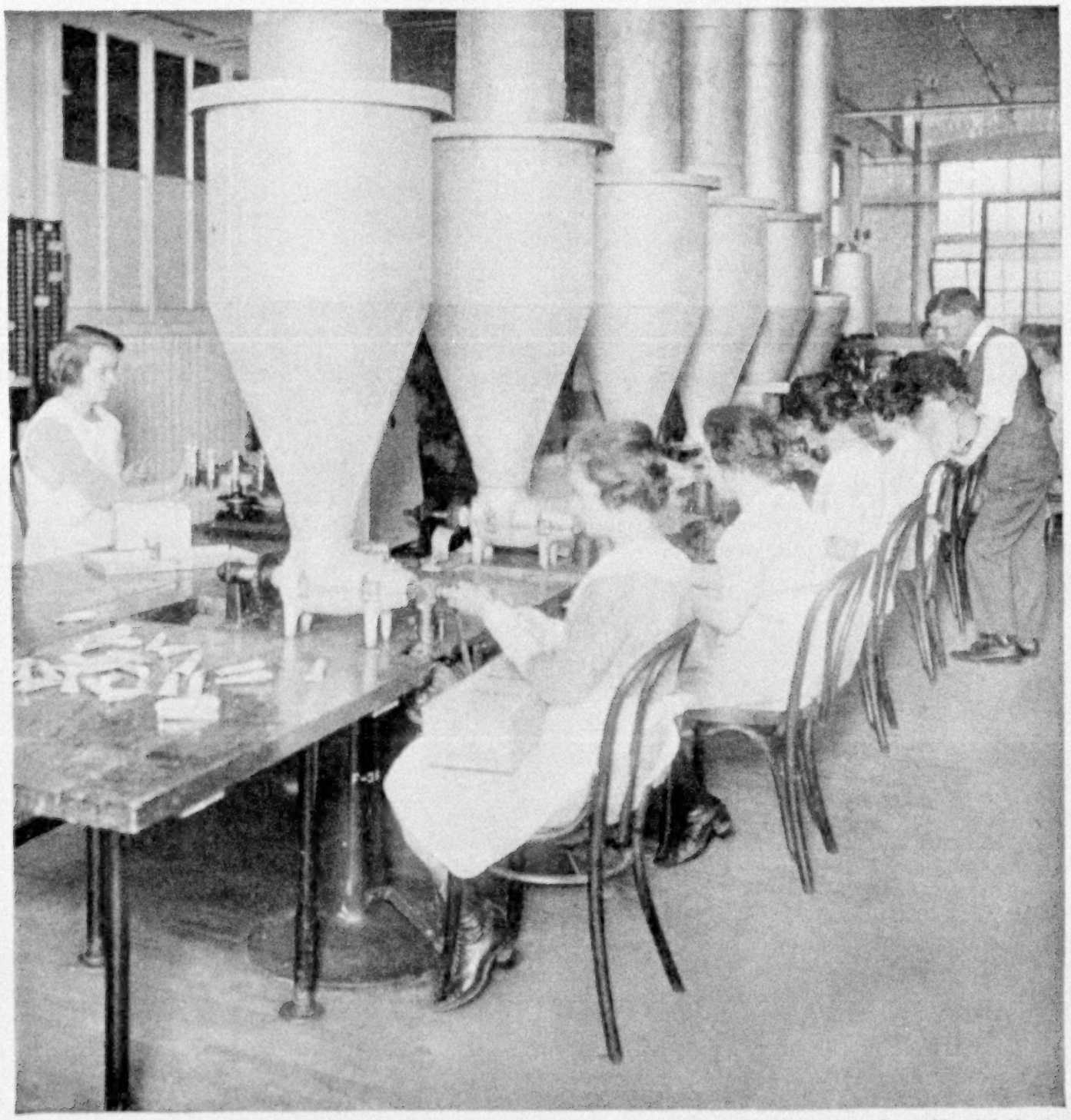
Manufacturing thrives in Massachusetts, but it does so at the expense of agriculture. No other State in the American Union has such a small proportion of its people engaged in the oldest of civilized vocations. Only one breadwinner in a score finds his food in farming, forestry, animal husbandry, and fishing.

What pathos there is in the thought that more than half of the ground the Pilgrim people for two centuries fought so hard to wrest from forest and stone should have been surrendered to weed and brush during the last three decades!

Motor out from Boston to Lexington, and thence by Bedford to Lowell. Did ever a hardy and spirited race leave a greater monument to its determination in combating inhospitable Nature than the farmers of bygone generations left in the thousands of miles of stone walls one sees in this part of Massachusetts?

Not only did they have to clear the ground of a stumpage that yielded little as lumber by way of compensation, but also of a vast amount of loose rock that occurs so frequently where the soil is best.

The result was that fences were built, not with reference to the needs of height and width in field boundaries, but rather of dimensions sufficient to provide a storage place for the vast amount of rock that had to be removed before the plow and the harrow could make ready the soil or



Photograph by Leon H. Abdalian

FILLING TUBES WITH TOOTH PASTE: MASSACHUSETTS

The big containers are full of paste. Each girl can fill 10,000 tubes a day. Everywhere one goes in the Bay State labor-saving machinery is in evidence. Yet everywhere the more labor is saved the more work there is for labor to do.

the corn and wheat find a place to grow. Some of these stone fences are so thick that a carriage and pair could drive along the tops.

THE FARMER'S LOSING BATTLE

For more than two centuries the sturdy yeomen of Massachusetts waged an aggressive battle against the forests to obtain room for their crops. Then, in 1850, came a stalemate, and for thirty years the battle line between the field and the forest showed a little wavering, but no real change.

But when it seemed that a draw was the inevitable end of the struggle a new ally appeared on the side of the forest. High wages and short hours for labor in urban industries began to cause wholesale desertion from the forces of the farm.

Then the line wavered and broke; in

COTTON AS IT COMES INTO THE FACTORY

When cotton reaches the factory in the bale the fibers are kinky and tangled, like a bunch of snarled hair. One pound out of every four of the bale's weight is due to the dirt, sand, and other foreign substances in it. Massachusetts annually spins a million bales like the one shown here.

the thirty years, 1880-1910, that followed, the forest was able to retake from the field half of the territory the hardy farmer had won, and has left the State only a little more than a million acres of improved land where formerly it had considerably more than two million.

Nor is it to be doubted that this year's census will show even larger losses in improved land. One has only to motor through the better farming communities to see thousands of acres that have been abandoned recently, and to find "For Sale" signs along every highway; for how few farmers can withstand the lure of $40 a week for himself, $30 for his wife, and $25 for his daughter, with eight hours a day for everybody!

This tremendous slump in agriculture has taken place in spite of the fact that, acre for acre, the value of Massachusetts crops is probably higher than that of any other State in the American Union. Furthermore, it is in spite of the fact that some of the most fertile farming land in America is to be found in the Bay State adapted for the growth of specialties, seeds, onions, etc.

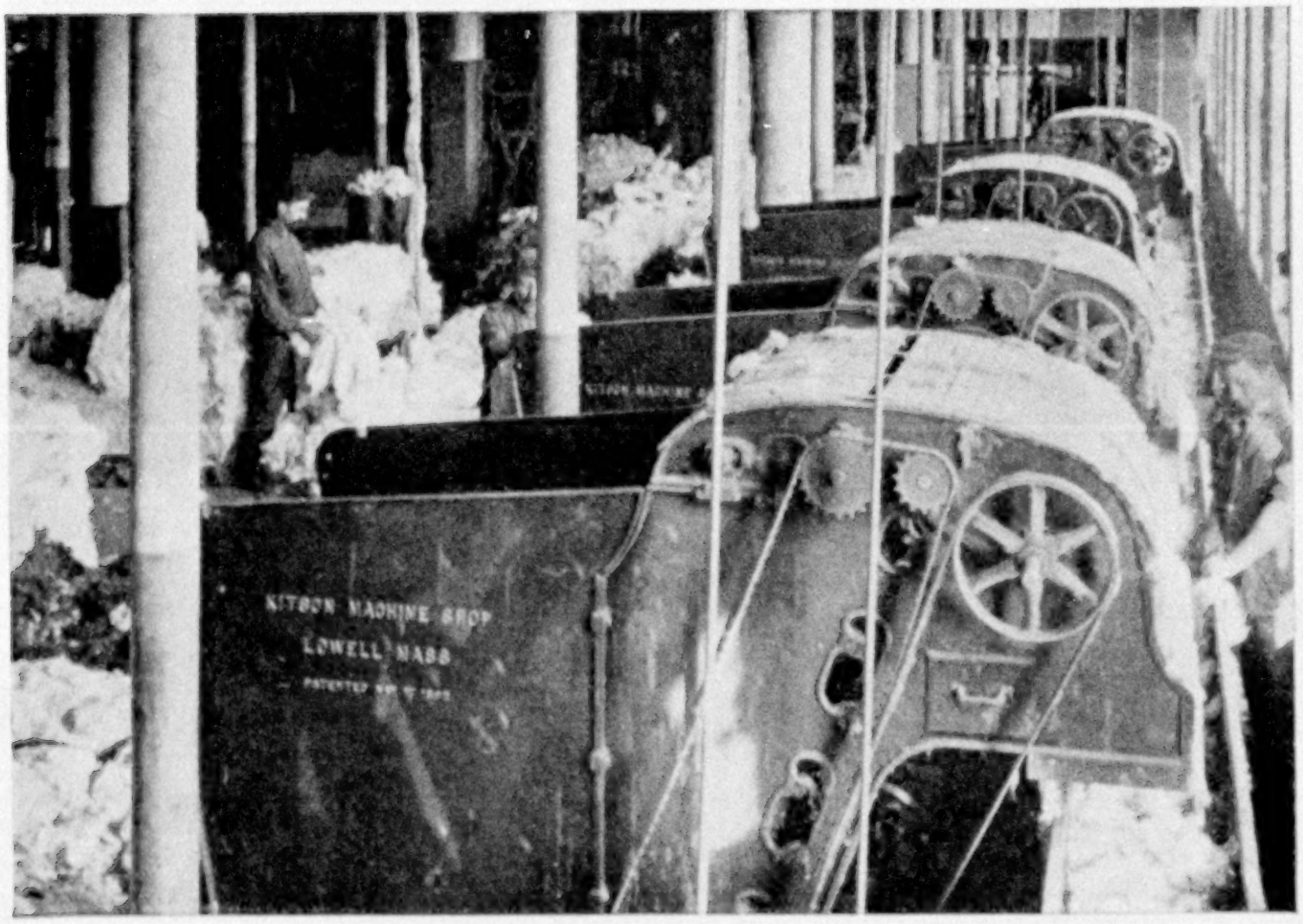
The Massachusetts Agricultural College is intelligently striving to offset the sweep of the tide that is carrying people from the farm to the factory. The task is a hard one and the odds against its accomplishment are tremendous, but much good is being done.

Massachusetts was one of the first to appreciate the advantage of good roads and to undertake a State-wide program of highway construction. Many millions of dollars have been spent in perfecting a system of trunk lines. The result is that the whole State is a paradise for the summer motorist, and tens of thousands of Americans gather in this vacation land, which can suit every taste and pocketbook.

A statistician has estimated that summertime visitors swell the population by one-fourth. That is probably an overestimate, but it gives some idea as to the influx of folk on vacation bent.

HISTORIC ASSOCIATIONS PRESERVED

Just as Massachusetts was a pioneer in recognizing the advantage of good automobile roads, it was also the first State to appreciate the development of its historic resources. There are mark-



THE BALE-BREAKER AT WORK

After the bale of cotton has been opened, the workmen feed it into the machine shown here. This machine loosens the mass and delivers it to an endless belt (shown on the right), which carries it to the feeders (see page 211).

ers from mountain to sea, telling in brief outline the history of hallowed spots. Only those who have traveled through the State can appreciate the extent of this work or realize how much it adds to a pilgrim's pleasure and stirs anew the Americanism within him.

The irreverent outsider may be disposed to smile at the fact that there is not an elm tree under which George Washington is known to have stood that does not bear a distinguishing legend. He may even think that the Bay State overplays its history.

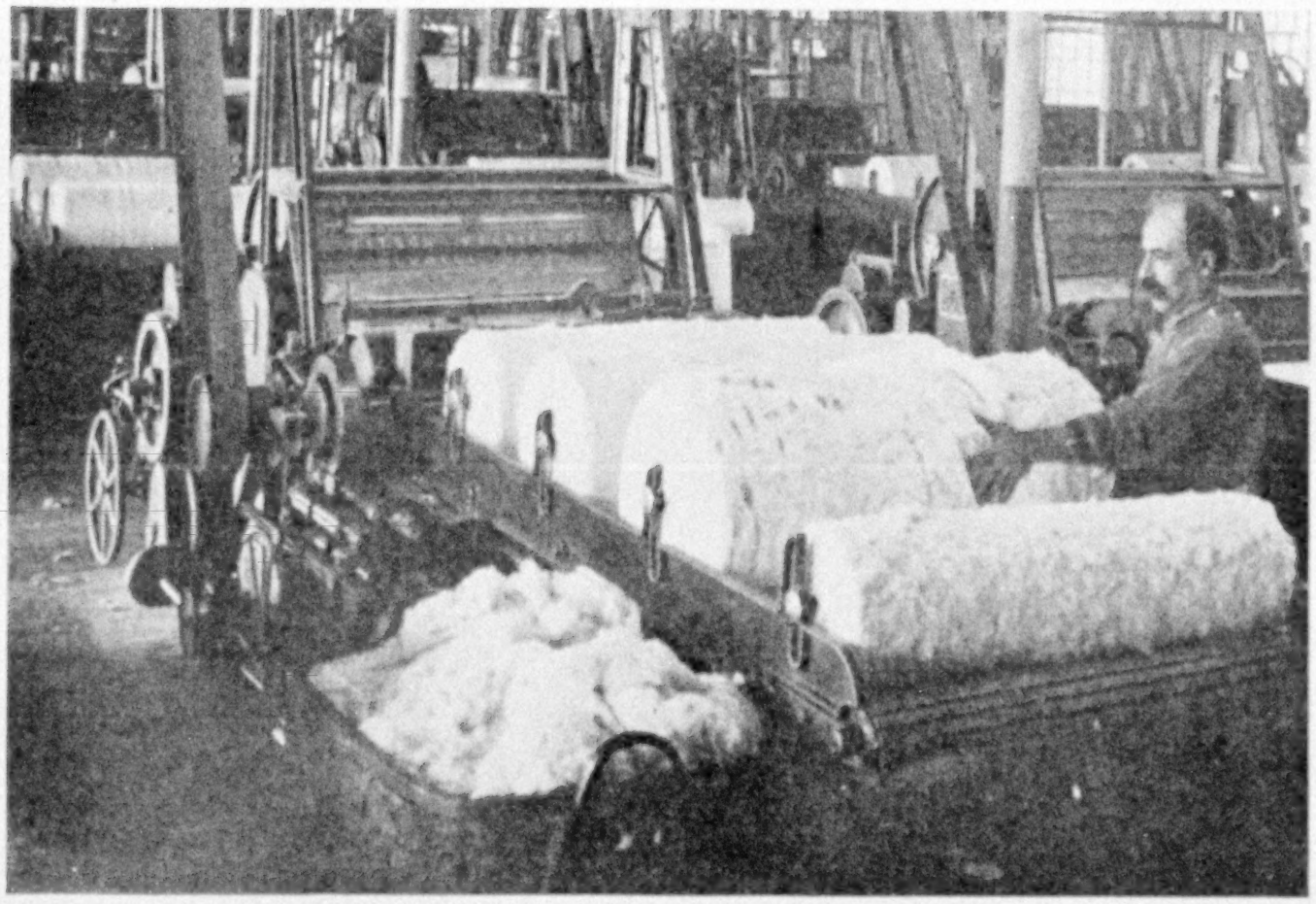
MASSACHUSETTS THE PATRON OF EDUCATION

But it were more nearly the truth to say that other States have underplayed theirs, and that every American would be a better American if all the States followed the example of Massachusetts in perpetuating the shrines of history in a way that would permit every passerby to read and reflect upon the nation's glorious heritages.

From its earliest days the State has led the nation in matters educational. Here the first colonial grammar school was established, the first college, the first elementary free school, the first academy, the first high school, and the first normal school.

Call the roll of the higher institutions of learning—Harvard and Holyoke, Amherst and Williams, Smith and Wellesley, Tufts and Massachusetts Institute of Technology, Clark and Radcliffe, Clarke Institute of Northampton, and many others—and most of them will be found to have been pioneers in their respective fields and to stand today each for some special ideal.

But Massachusetts is entirely democratic in her educational activities. The unfavored many have as much right to their opportunity for training as the fortunate few. High schools of excep-



THE INTERMEDIATE PICKER, WHICH CONTINUES THE WORK OF CLEANING RAW COTTON

From the bale-breaker the raw cotton goes through the feeder to the opener, and thence to the three "pickers," which still further loosen it and release each fiber from the grasp of its neighboring fibers. The four "laps" (the round cotton mass) of cotton on the machine are being combined into one lap (see picture on opposite page).

tional merit are to be found in every community and technical schools in the larger industrial centers.

In 1913 a law was enacted requiring every town without a high school of its own to pay tuition in other towns for its high-school pupils, and to pay their transportation back and forth, up to $1.50 a week, thus guaranteeing to every boy and girl in the Commonwealth who desires it a free high-school education. In 1918 another law was enacted granting State aid to struggling high schools.

As in so many other directions in the educational world, Massachusetts was a pioneer in exchanging the little red school-house on the hill, with its ungraded course of studies, its untrained teacher, and its poor facilities, for the consolidated school, with its fewer and better teachers, its carefully planned courses of study, etc. It did so on the basis that four good teachers in one consolidated school could teach twice as many children twice as much as eight poor teachers in eight little red schoolhouses.

Latterly the children at distant points have been conveyed to and from school at State expense. It costs half a million dollars a year to convey to school those children who do not live within walking distance, but that is only a trifle compared to the advantages which result from educating the 20,000 children affected. Of this number nearly half go by trolley, nearly a third by horse-drawn vehicles, and a fifth by motor busses. The figures indicate that it costs less to take the children to school in motor cars than in horse-drawn vehicles.

But with all the progress which Massachusetts has made educationally, there are still 600 teachers in the State with salaries of less than $550 a year. Adequate pay for teachers is recognized as one of the first requirements in any campaign for an improved education pro-

gram, and the Bay State is moving in that direction.

THE HOME OF THE CONVEYING MACHINE

Massachusetts has long been preëminent in the development and introduction of labor-saving devices, but in no field more so than in the evolution of automatic conveying machines.

Go into a chain drug store, a large department store, or a big business office, and the pneumatic tubes and cash-carriers installed there probably came from Massachusetts. Very probably your sterilized milk is handled in the dairy on Massachusetts-made gravity conveyers.

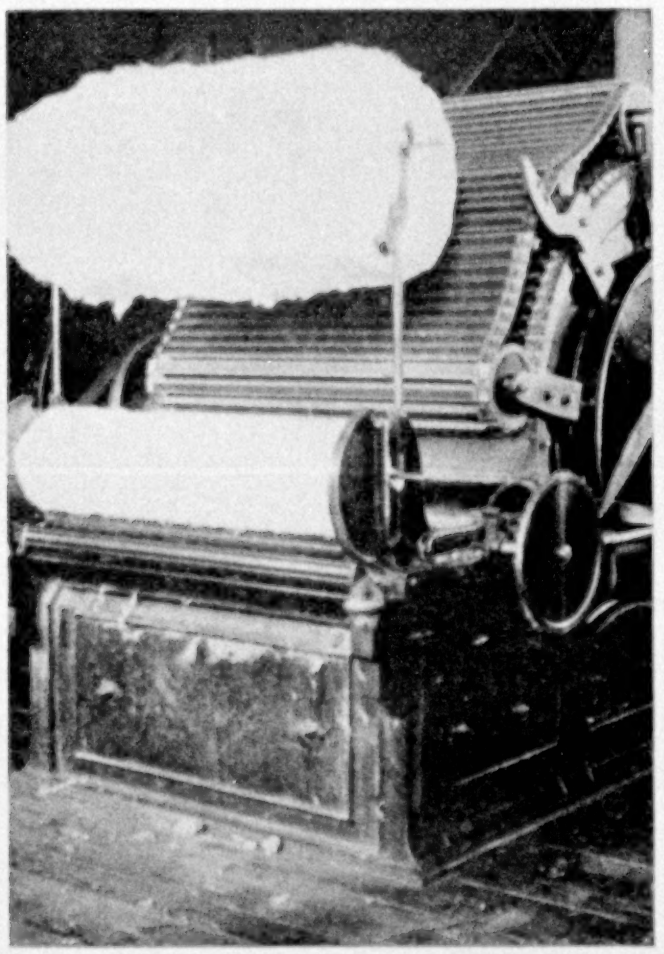
Indeed, at every turn one comes into contact with something that has been carried by these Massachusetts step-savers—mail, shoes, hats, watches, money, books, hotel food.

Mechanical messengers "made in Massachusetts," which are as fast as their human prototypes are slow, are found in every State. Some of them seem to act with even more intelligence than the lead-shod messenger of flesh. In one type there may be a dozen or more receiving stations along its route, but it unfailingly carries its burden to the one to which it is directed by the sender.

In a big bank the paying tellers cannot always tell the status of certain accounts when checks are presented; but down beneath the counter of their cages they have pneumatic tubes. Into one of these the teller puts the check in question; it is conveyed to the bookkeeper, who scribbles his initials of approval upon it, and before the patron at the window has time to suspect that the drawer's account is being examined, the check has been returned to the teller and payment is made.

MASSACHUSETTS ANNUALLY MAKES A SHOE FOR EVERY FOOT IN THE UNITED STATES

Space forbids even the enumeration of the many services performed by gravity, pneumatic and electric belt carriers, but millions of hours of labor, millions of dollars' worth of customers' time are saved every day in America by "made in Massachusetts" automatic messengers and merchandise movers.



A COTTON CARD AT WORK

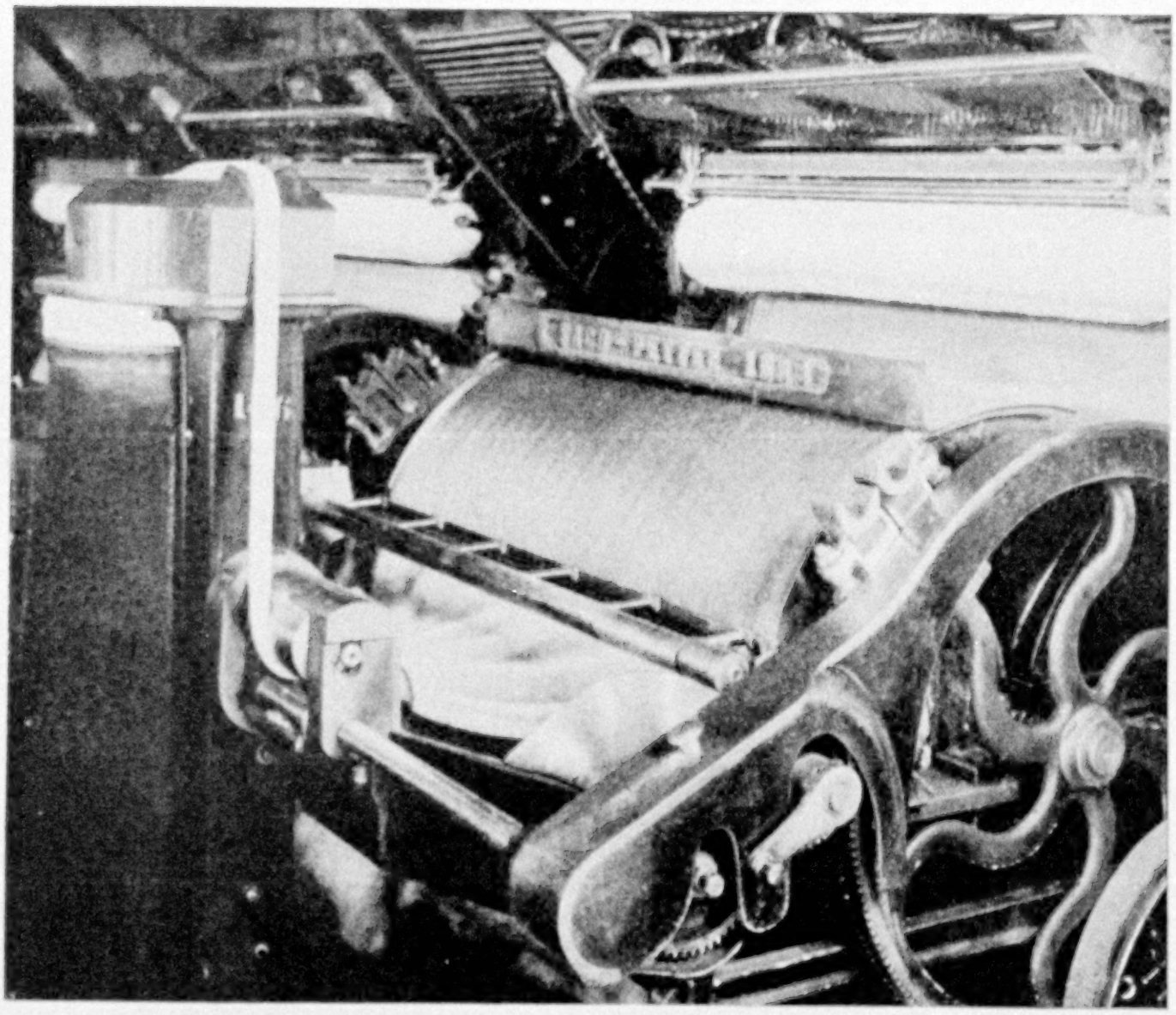
Here the big rolls of "lap" are fed between two cylinders which are covered with leather or cloth, studded with tens of thousands of tiny spikes. These barely miss each other, but they comb out the fibers of cotton until they all lie parallel to one another (see page 212).

The story of the factories of the Bay State is a narrative of an astonishing concentration of human endeavor.

In quantity no less than in value do the manufactures of Massachusetts amaze. A boot, shoe, or slipper for every human foot in the United States; more cotton goods than the whole world produced when John Adams was President; enough hosiery to cover 40,000 miles of feet and legs; sufficient woolen goods to put a twenty-foot bandage around the waist of Mother Earth—these are some of the yardsticks that measure the annual activities of this beehive of industry.

Of course, when one thinks of Massachusetts industry, the manufacture of textiles comes immediately to mind.

Think of twelve million flying spindles converting fiber into yarn and thread, each of them dancing around its own axis at rates varying from 5,000 to 10,000



THE DELIVERY END OF A CARDING-MACHINE

Here we see the "lap" spread out in gossamer-like thinness over the card cloth. The filmy sheet is then gathered into the "sliver"; the sliver is the white streamer clearly pictured on the extreme left. The second stage in the conversion of raw cotton into plain yarn now begins.

turns a minute. Placed end to end, these dancing dervishes of the textile industry would reach from Montreal, Canada, to Memphis, Tenn.

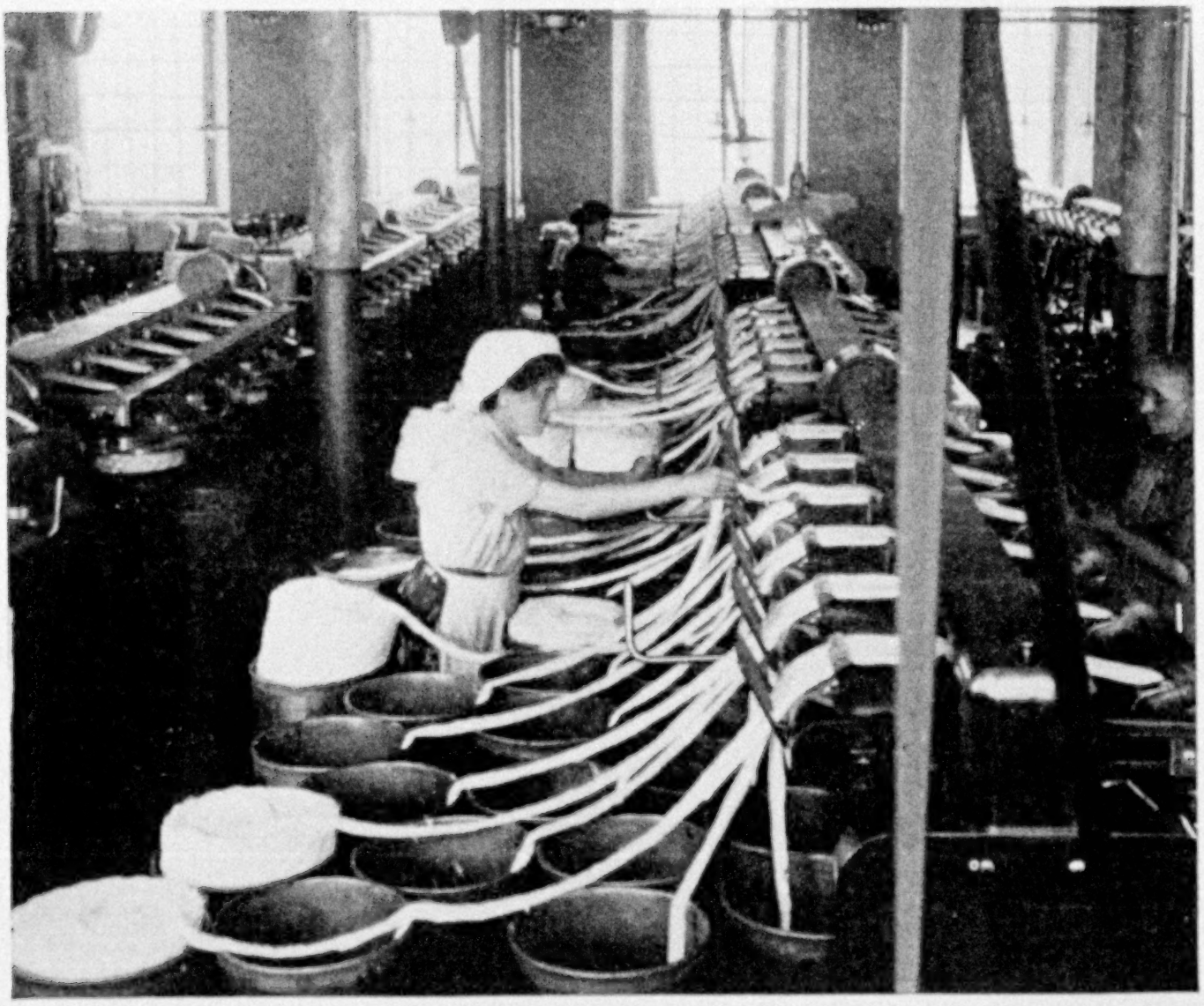
EIGHT MILES OF COTTON CLOTH MADE EVERY MINUTE

Then there are the looms, a quarter of a million of them. Put these cloth-making machines together, end to end, with no aisles between them, and the weaving shed required to house them would begin at Boston, Mass., and end at Wilmington, Del. Every third spindle and loom in the United States is humming away in the cities and towns of the Bay State.

Of the textiles, cotton is first, some two billion yards of woven goods leaving the cotton looms every year. That means cloth flowing from machines at the rate of nearly eight miles a minute! It is sufficient piece goods to make a woven belt long enough to hitch the moon to the earth and more than six feet wide! Of sheetings, shirtings, and muslins Massachusetts produces about thirteen yards for every person in the United States; of fancy woven material, nearly four yards; of napped fabrics, more than one yard; of velvets, corduroys, etc., nearly a yard.

THE STORY OF A YARD OF CALICO

A piece of simple calico seems a mere trifle; but the story of its manufacture is an epic of genius. Followed from the raw cotton in the bale to the bolt of cloth



"DRAWING" SLIVERS IN A COTTON MILL, ONE OF THE STEPS PRELIMINARY TO SPINNING

When the sliver comes from the card, as shown in the preceding picture, it is received into one of the cans shown here. Six of these slivers pass through the drawing frame, as explained on page 214, and are combined into one, as long as the combined length of the six, but of the diameter of one of the originals. Each sliver passes through a number of drawing-machines, each time entering as six and coming out united into one, and correspondingly lengthened.

in the warehouse, it leads one a merry chase up and down countless flights of stairs and keeps the mind busy enumerating the processes involved.

Lawrence has one of the largest cotton mills in the world and, connected with it, the largest print works in existence. Let us there follow the processes of converting cotton into calico. We shall appreciate the clothes we wear the more when the journey's end is reached.

When the cotton comes to the mill it is in the familiar bales of commerce, 500 pounds to the bale. After being opened, the cotton is fed to a machine known as the bale-breaker. Here the matted cotton is loosened and torn into small bunches, which are delivered to an endless belt that carries them to the "feeder" (see page 207).

The feeder is a machine containing a series of pin-studded slats which carry the bunches of cotton in regular quantity into the next machine, known as the "opener."

The opener gives the cotton a warm reception—a terrific beating, indeed. It has a shaft on which there are mounted two rows of arms. This shaft revolves at from 1,200 to 1,800 times a minute, so that the cotton gets from forty to sixty slaps a second. The result is that the

"SLUBBER" MACHINES AT WORK IN A COTTON MILL

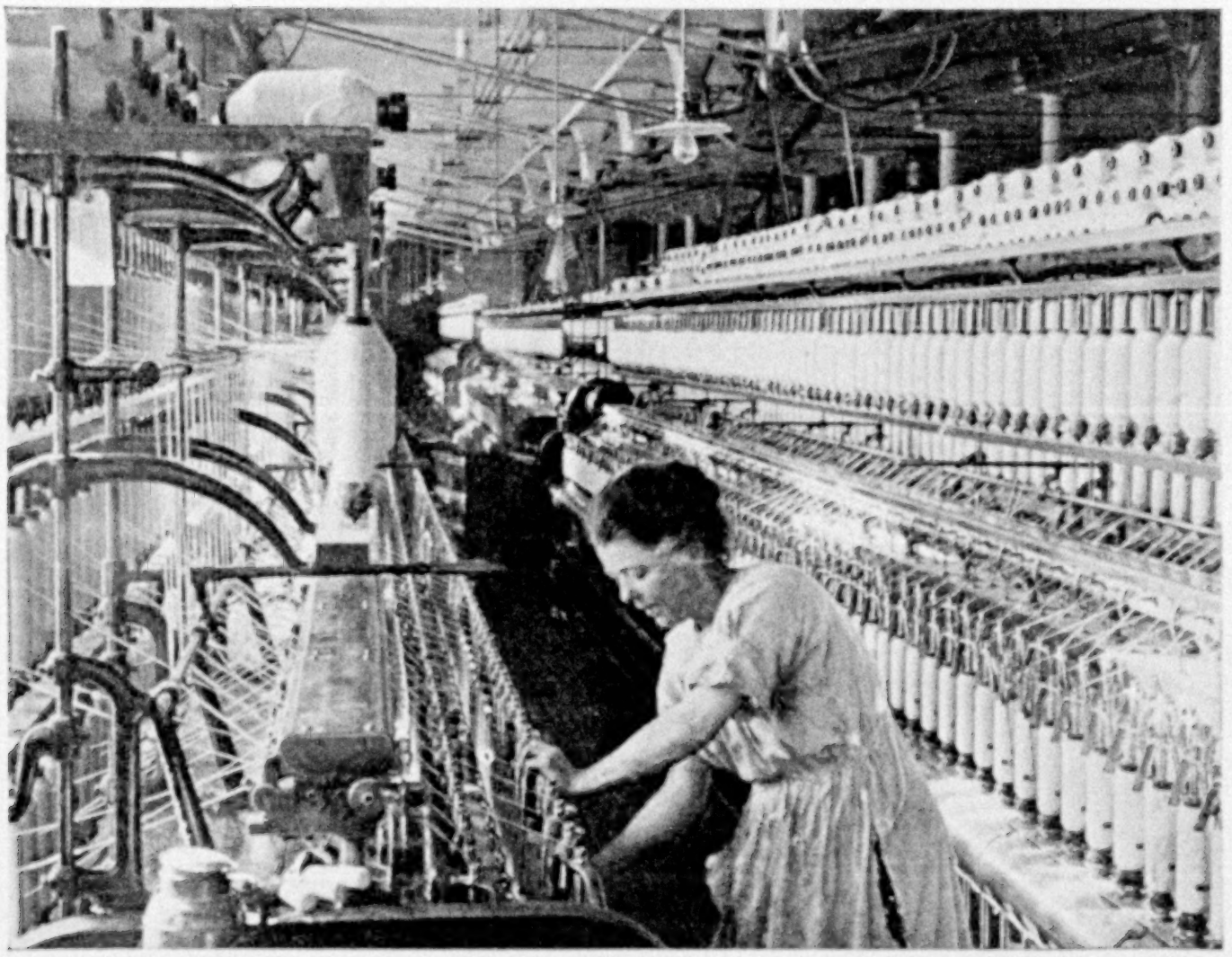
In this picture we see the slivers being drawn out of the cans on the right. As they pass through the slubber they are given a twist which makes each fiber take hold of its neighbor, and here they begin to acquire tensile strength. They emerge from the machine on bobbins as "roving." The cotton in the cans is "sliver," while that on the bobbins in the foreground is "roving" (see text, page 215).

sand and other foreign matter in the cotton lose hold. The opener then continues the work of picking the cotton to pieces. When the task is completed the staple is in tiny tufts. These are caught up by air suction, the dirt being left behind, and carried to the fourth machine, a "breaker picker."

The breaker picker gives the tiny tufts another beating, to remove persistent dirt, and then rolls them together in a great downy sheet on a rod. This sheet is known as "lap" (see page 208).

Four of these laps are fed simultaneously into a fifth machine, known as the "intermediate picker." Still another beater plies its flails upon the cotton as it comes in. The four laps that go into this machine come out as one.

In turn, four of these laps are fed into



THE FINE ROVING FRAMES IN A MASSACHUSETTS COTTON MILL

Here we see another step in the long process of converting cotton first into "lap" (pages 212 and 213), then into "roving" (page 215), and then into yarn. The machines in this picture give the roving the final stretching and twisting before it goes to the spinning frames, where it is converted into yarn (see text, page 216).

the sixth machine, known as the "finisher picker." It beats the cotton some more, and the four laps come out a further purified single lap, which looks like cotton batting—sixteen original laps condensed into one (see page 209).

After all these several and sundry beatings, one might think that no dirt would remain, but there are still some particles of leaf, seed pods, etc., clinging fast. Moreover, the fibers, which in ordinary cotton are about an inch long, are more or less matted.

So a seventh machine, known as the "card," is assigned the task of removing the remaining impurities, and of loosening or separating the fibers, so that they can be drawn parallel with each other. The card has two big drums, each covered with a wire-studded cloth and revolving so as barely to miss touching one another. There are some 72,000 of these projecting wires to every square foot and no fiber has a chance to escape its combing.

PREPARING TO MAKE THE THREAD

As it leaves the big drums the loose cotton is beautiful to behold. Perhaps forty inches wide, it is as thin as the skift of snow that falls on a late autumn morning. But promptly it passes through a set of reducing rolls which convert it into a rope about an inch in diameter, known as a sliver. This is coiled in a large can about three feet high and a foot in diameter (see page 210).

One might well think that, with such a great array of manhandling as this, the cotton would be ready for weaving; but in point of fact the process of reducing it to yarn is only barely begun.

A COTTON-SPINNER KEEPING THE THREADS OF ROVING RUNNING PROPERLY FROM BOBBIN TO BOBBIN

In spinning, the roving from the bobbin on top of the frame is fed through a little trumpet, and then through drawing rolls which further stretch the strand and make it smaller. After this it goes through a whirling piece of steel called the traveler, which winds it on another bobbin and gives it another twist. In the process of converting raw cotton to thread, the cotton fibers pass through six to twelve twisting-machines, depending on the quality of the thread to be produced.

The next step is to put the sliver through the drawing frames. Six slivers as they come from the card are combined into one in the first frame, which consists of a series of rolls, the last pair of which revolve six times as fast as the first pair, thus making the sliver that comes out of the frame six times as long, but of the same diameter, as the ones that went in. Six of these latter slivers, in their turn, are fed into the second drawing frame and transformed into one. The final frame takes six of these, in turn, and transforms them into one (see page 211).

In other words, just as the final lap is composed of sixteen original laps, so the

A DOFFER GIRL IN A LAWRENCE COTTON MILL

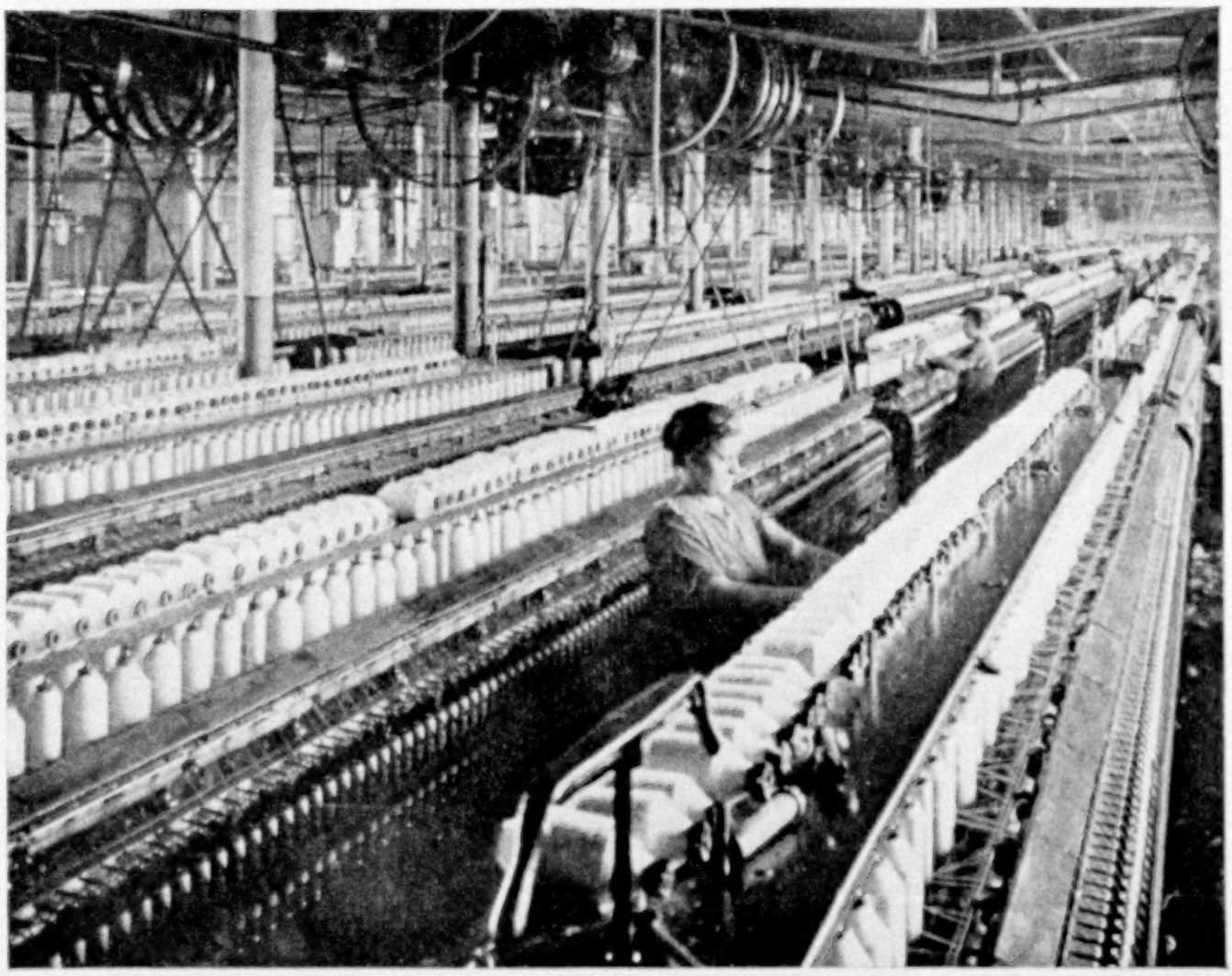
This young lady takes the bobbins from the spinning frame as they become full of yarn. Acres and acres of fast-flying spindles and whirling bobbins are found in Massachusetts. All the bobbins, placed end to end, would reach from Montreal, Canada, to Memphis, Tennessee.

final sliver is made up of 216 original slivers; but it has gained in length all that has been lost in diameter.

But up to date the sliver is only a mass of parallel fibers and has no strength whatever. The succeeding three operations are intended to give it a certain amount of twist, so that the fibers will cling together, while the size is reduced.

In the first of these operations final slivers from the drawing machine are fed into a machine known as a "slubber." It takes these and simultaneously twists and stretches them into one strand, much longer, but with a diameter reduced to that of a clothes-line; this it winds on a headless-spool bobbin. This resulting material is called "roving" (see p. 212).

Two strands of this roving from the slubber are next twisted and stretched



A SPINNING-ROOM IN A LAWRENCE COTTON MILL

The cross-threads, or woof, of cotton goods are not twisted as much as the lengthwise, or warp, threads. The function of spinning is to twist the fibers together tight enough to give the yarn or thread the desired strength. If a thread be completely untwisted, it will be found to be nothing more than a series of fibers an inch or an inch and a half long.

into one, which is wound on bobbins of the "intermediate frames."

Two of these intermediate rovings in their turn are twisted and stretched into a final roving, which has about the diameter of the string which the grocer uses in tying packages.

Sixteen laps to a sliver, 216 slivers to a roving, 8 rovings to a strand of yarn—27,648 doublings from original lap to unspun yarn!

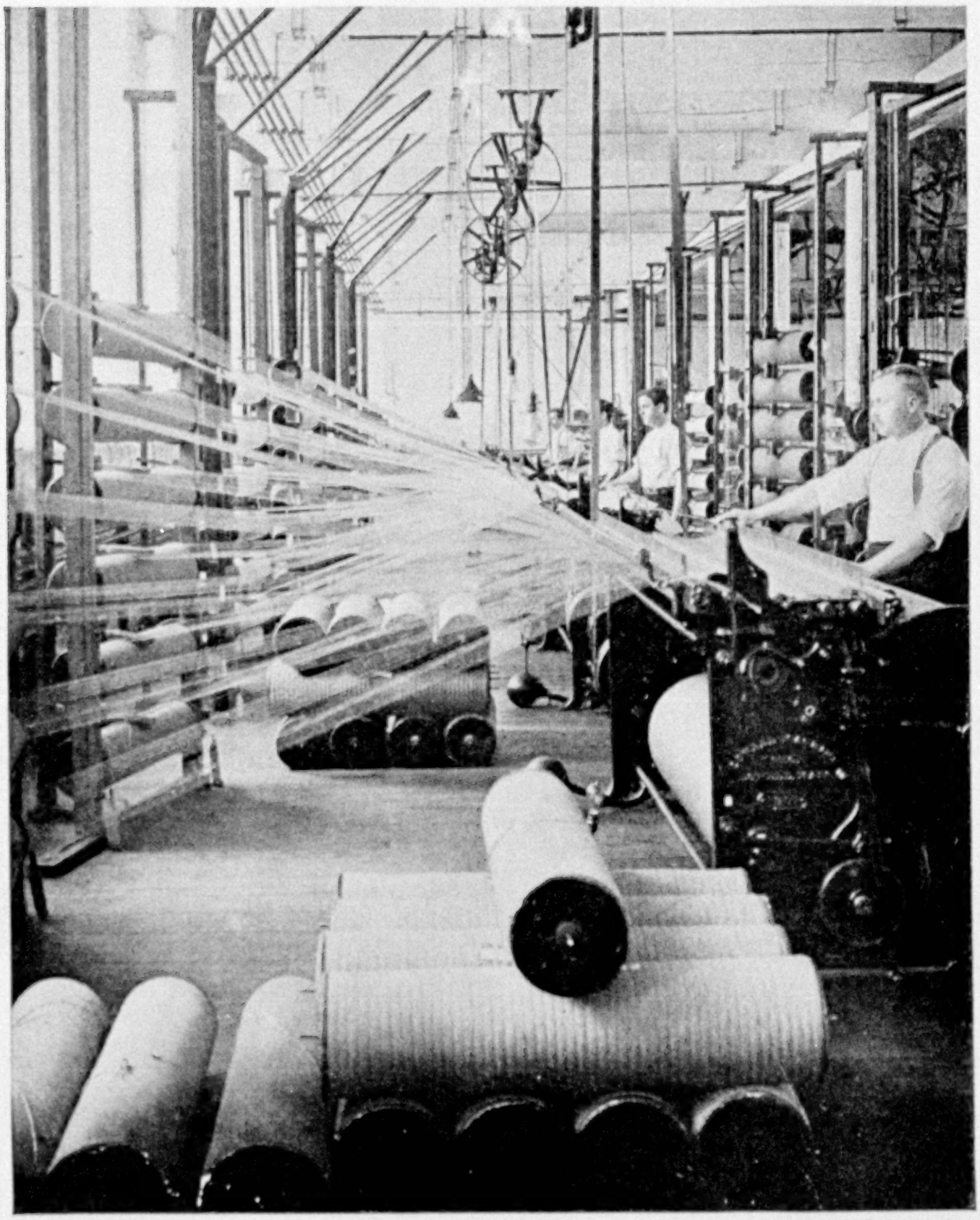
The bobbins containing the final roving are now set up on the creels in the spinning frame. A strand of the roving goes through a trumpet and then through a set of three rolls running at different speeds, which still further stretch it, until it becomes the size of yarn wanted. Next it passes through a small rounded piece of steel, called the "traveler," which runs at a very high speed—sometimes fifty miles an hour—on a ring, in the center of which is the fast revolving spindle. From the traveler the yarn is wound on the bobbin on the spindle and gets the required twist.

If the yarn is intended for "woof," or across-the-goods thread, it is wound on appropriate bobbins and is ready for the loom. The cotton has passed through fourteen machines to reach the woof stage—seven, up to and including the carding machine, three drawing machines, three roving machines, and the spinning frame.

MAKING THE WARP THREAD

But if it is to become "warp" thread, that which runs lengthwise of the goods, the yarn has yet to go a considerable journey.

The bobbins of warp are taken from



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A WARPING-MACHINE IN AN UP-TO-DATE TEXTILE FACTORY

Here is shown the process of assembling the warp threads on the "loom beam" ready for weaving cloth. After the yarn has been sufficiently twisted to give it the required strength for warp, it is wound on spools. The contents of these spools, in turn, are wound upon the large rolls seen in the foreground, some 400 threads to the roll. These rolls are placed in the creel, or frame shown at the left in this picture, perhaps six at a time. There the threads are unwound from them, and, passing through a "slasher," or stretching and drying machine, they are consolidated on one great roll known as the loom beam. The loom beam may be seen on the right. With its load of thread, perhaps 2,400 individual strands, this loom beam is put into the loom (see next page, 218), and each thread through its particular "eye" in the loom harness, and then the conversion of thread into cloth—weaving—is ready to begin (see text, page 220).

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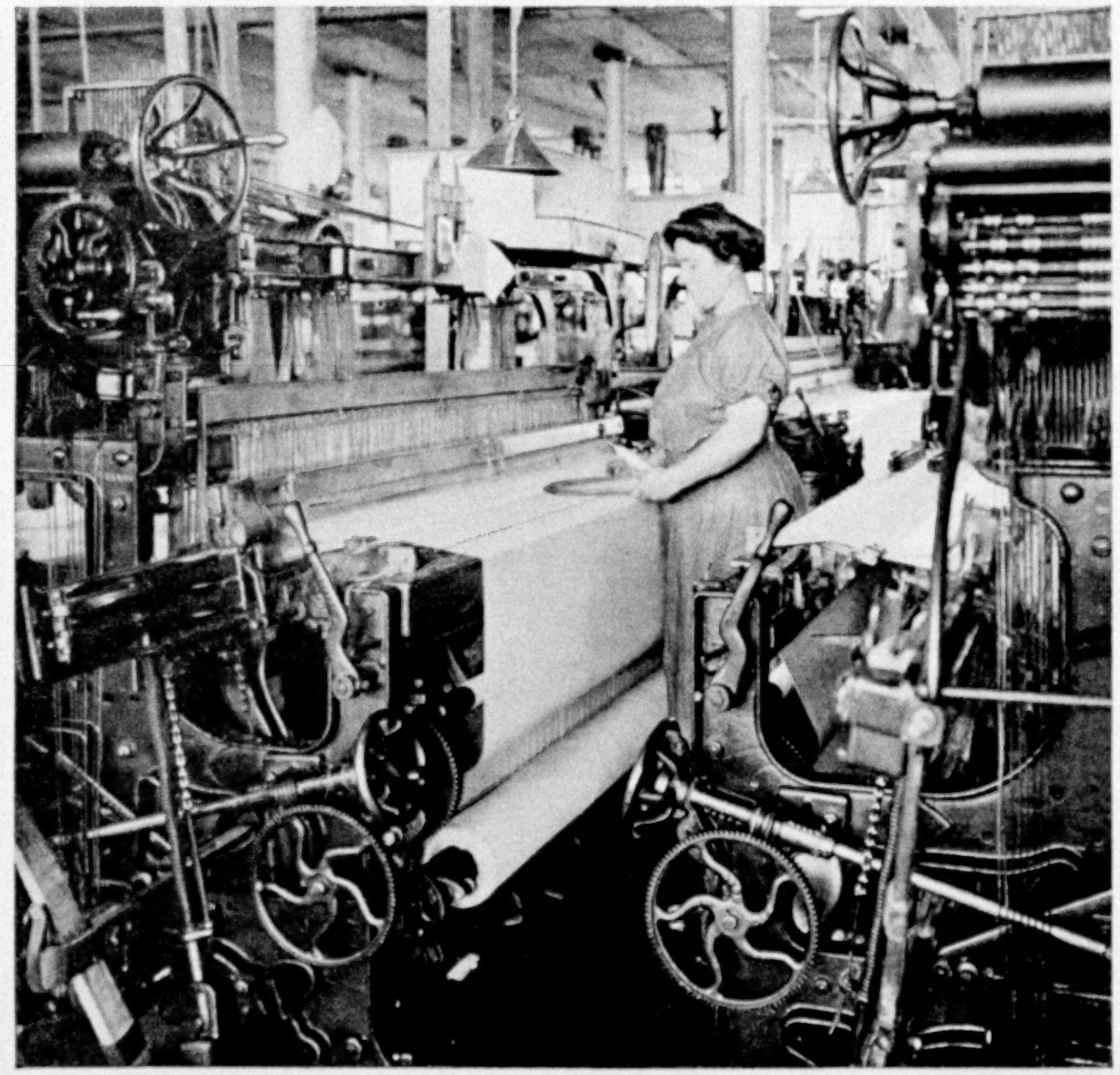


© American Woolen Mills

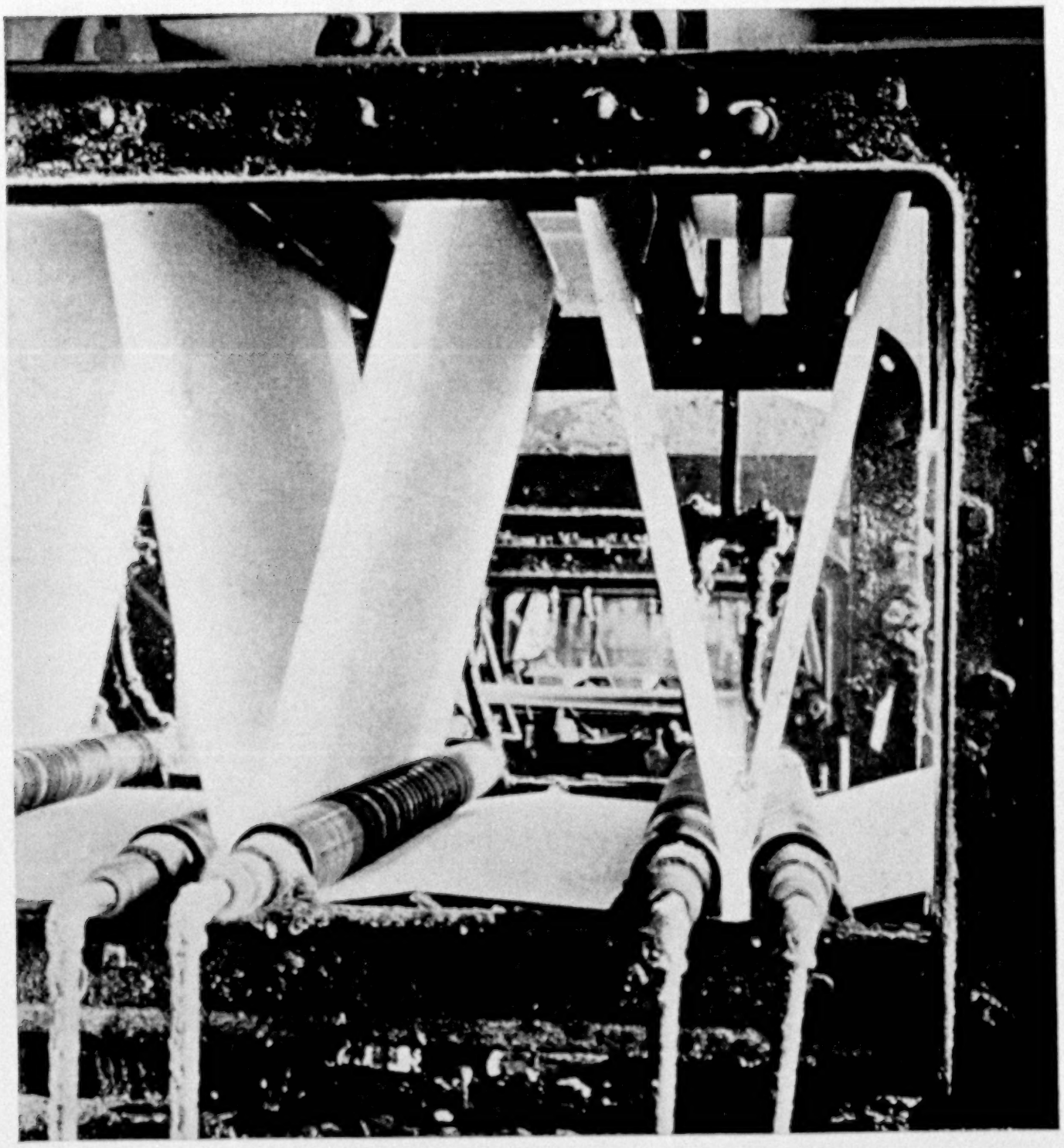
A GROUP OF LOOMS IN A MASSACHUSETTS MILL

These are the machines that receive the loom beams shown in the preceding picture and convert the yarn into cloth, weaving the warp and the woof together. In the simplest woven goods the shuttles containing the woof ply back and forth across the loom, passing under each alternate warp thread and over the others. In the fancy weaves the warp may go through half a dozen or more harnesses, instead of the two used in simple weaves.

the spinning frame and put on the "spooler." Here the yarn is wound upon large spools that hold about a mile of thread. For tying the ends together, the girl in charge of the spooler has a novel knot-maker that fits in the palm of her left hand. She takes the two ends, places them across a little hook, shuts her hand and opens it again, when, presto! the knot is neatly tied and the ends cut off!

After the warp is wound on the spools, three or four hundred of the latter are set in a frame known as the "warper creel." These threads are all tightly wound, side by side, on a big reel, known as a "warper beam."

To make an average piece of goods forty inches wide requires about two to three thousand warp threads; if 2,000, five warper beams, each containing 400 threads, are put into a machine known as the "slasher." Their yarn is unwound and passed through a box of hot starch and then around two copper cylin-



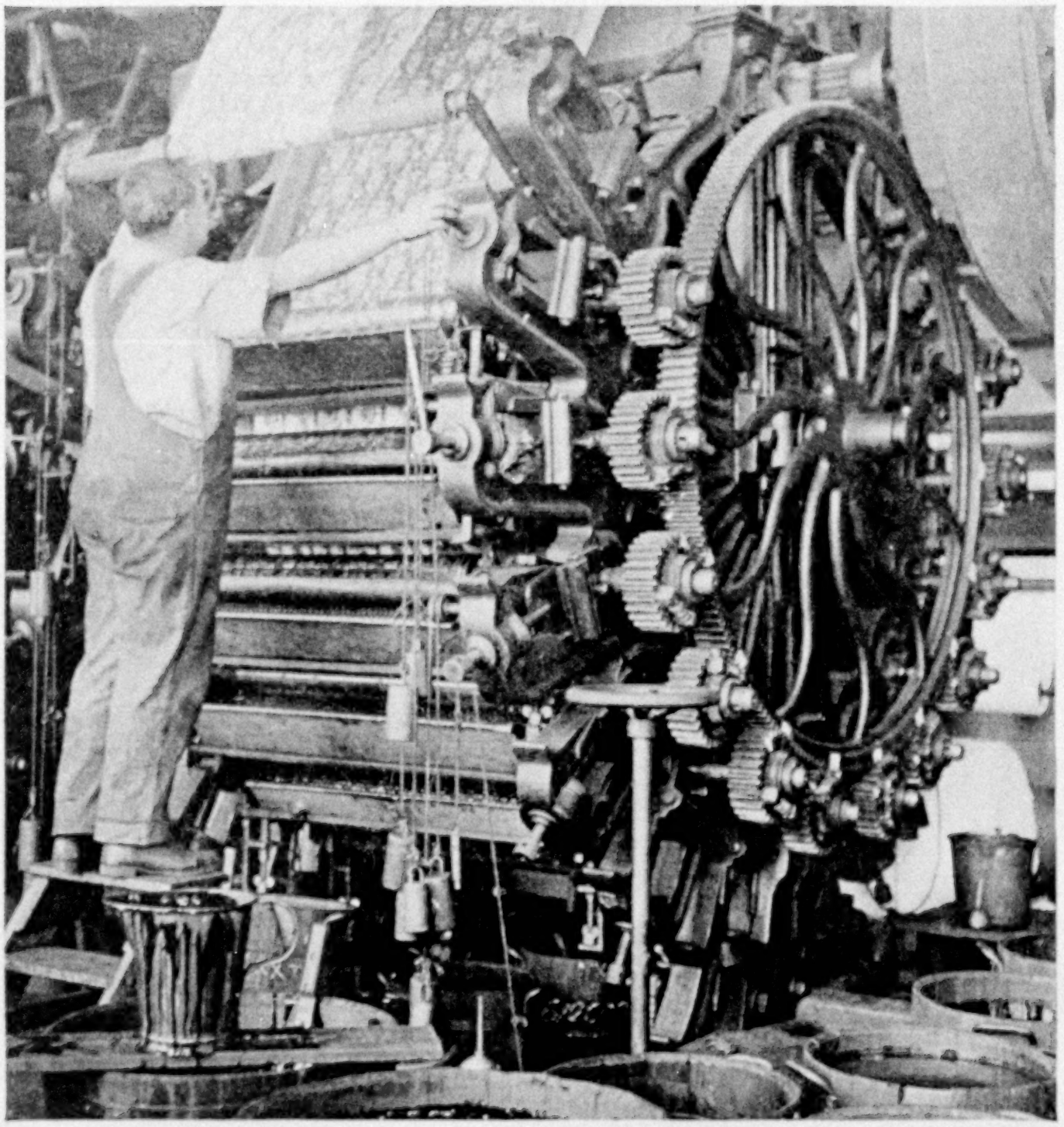
SINGEING CLOTH PREPARATORY TO PRINTING

Before cloth can be printed, all the little knots and threads and fuzz must be eliminated. A machine working on the principle of a lawn-mower first passes over it and eliminates all the knots and threads. Then the cloth goes through a singeing-machine, passing over a gas flame at a speed which permits all the fuzz to be burned off, but which saves the cloth from being scorched.

ders filled with live steam. Thus starched and dried—a process serving to make the yarn less apt to tangle and less liable to injury by the friction of the shuttle—it is wound around the "loom beam."

When the housewife uses her sewing-machine she has to "thread" it first. So, also, in weaving, the loom must be threaded with the warp. For plain weaving there are only two sets of "needles" to be threaded. These are known as harness, and consist of wires or twine cords, each with an "eye" in the middle. Each alternate thread goes through an "eye" of one harness, and the others through the corresponding "eyes" of the other harness.

Fancy weaves require more harnesses



A CLOTH-PRINTING MACHINE; LAWRENCE, MASSACHUSETTS

To see white cloth entering one of these big presses and coming out at a speed of thousands of yards an hour, with a dozen different colors, every one in perfect register, is to realize how much science has done to give us attractive clothes.

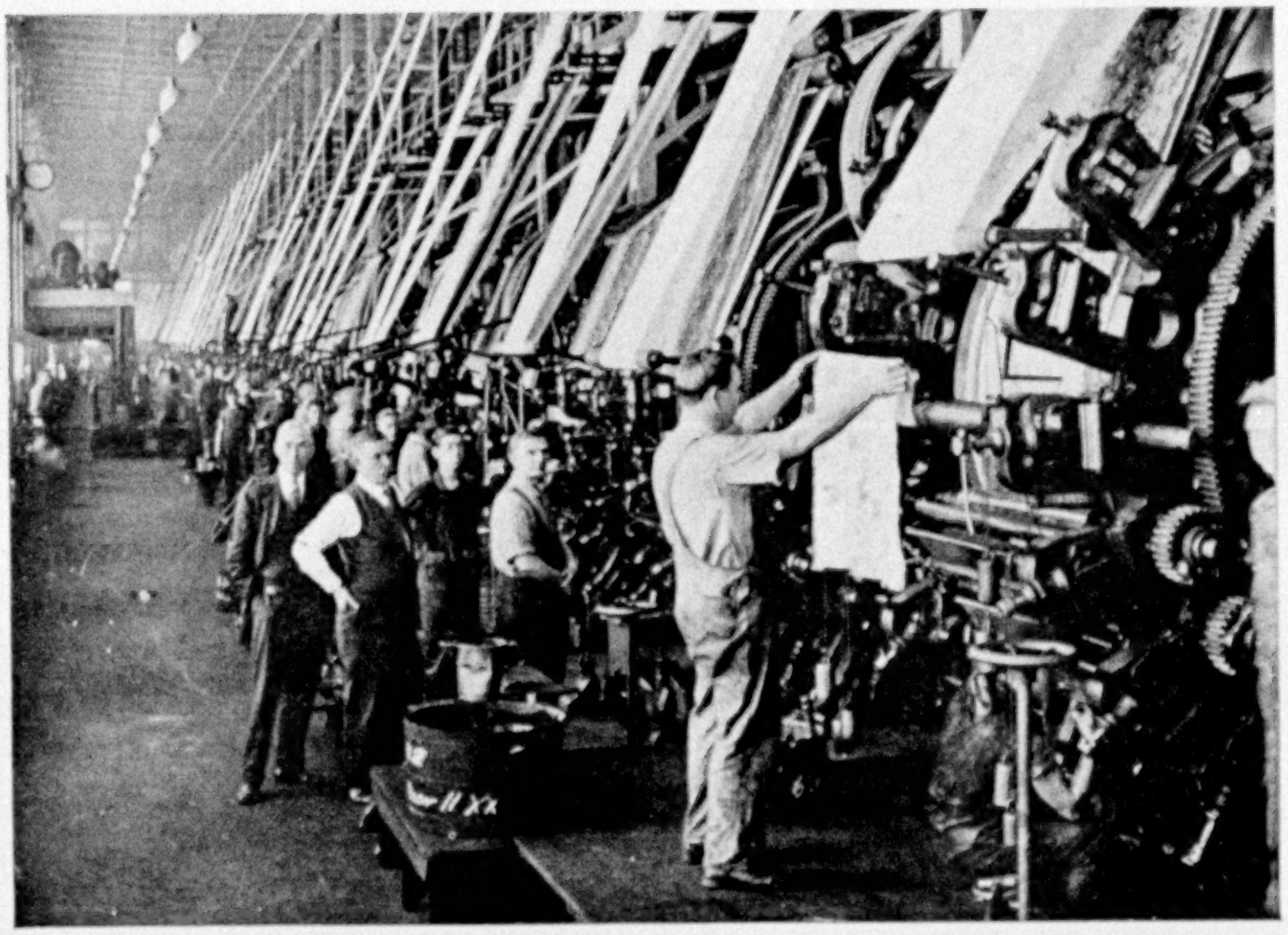
and complicated threading, but they need not be described here.

HOW THE CLOTH IS WOVEN

In the weaving process for plain cloth the one harness goes up as the other goes down, so that the shuttle with the woof passes under every other thread and over the alternate ones. Next trip through it passes over the ones it went under before and under those it passed over.

When a new lot of identical warp is to be put into the loom, the slow process of threading the harness is not resorted to; rather the ends of the old are knotted to the ends of the new.

To tie 2,000 knots is no mean job. It is performed by a little machine that can tie 240 knots a minute—four a second. The ends of the threads of the old warp are placed alongside those of the new and the tying mechanism set in motion.



A BATTERY OF FORTY-EIGHT PRINTING-MACHINES AT WORK: LAWRENCE, MASSACHUSETTS

One Massachusetts cotton mill produces five hundred miles of cloth a day, and a large percentage of this passes through the printing-machines here shown, said to be the largest group of its kind in the world.

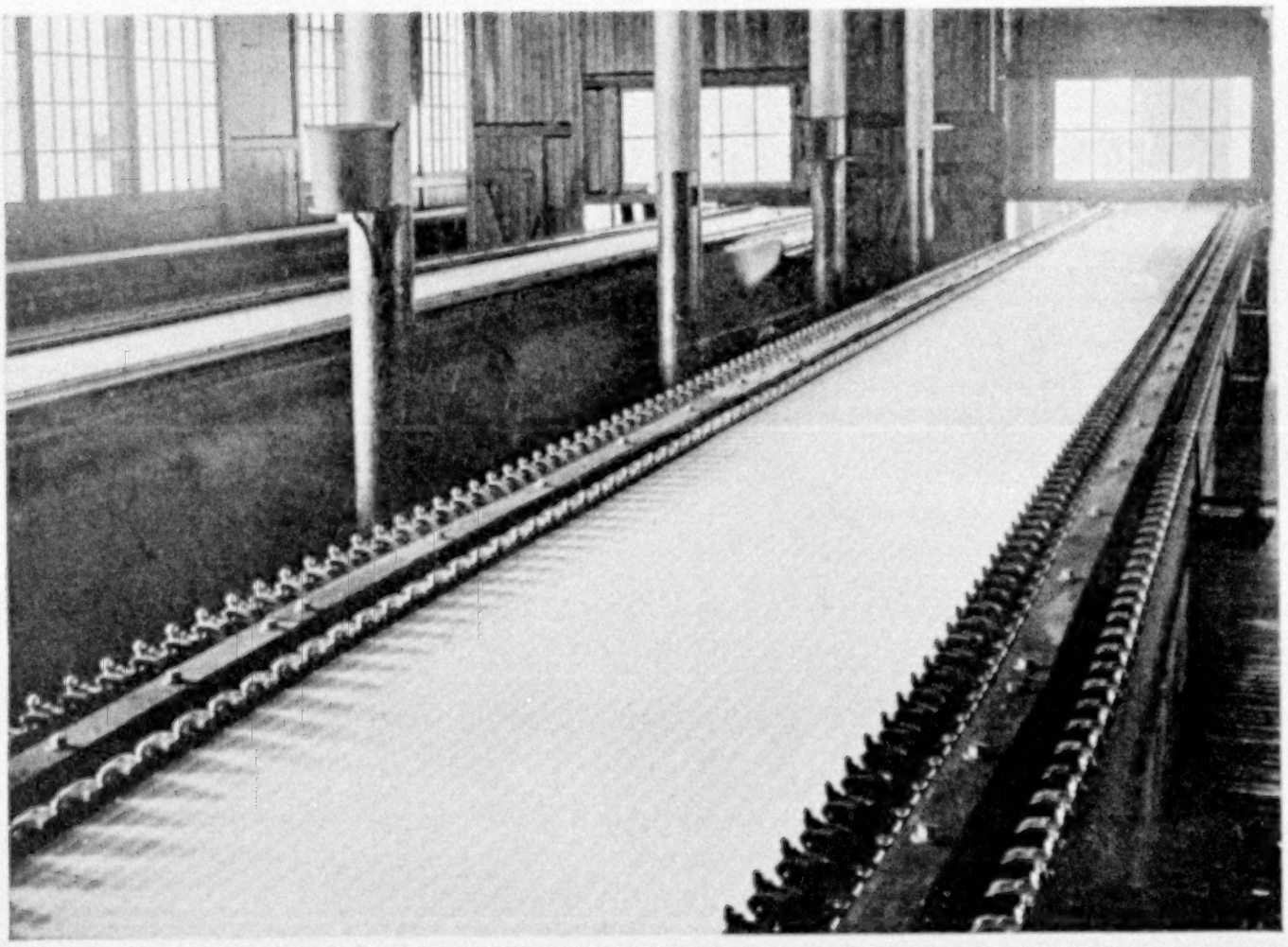
It rattles off the knots about as fast as a machine-gun pumps out bullets. If it fails to get both ends properly in its grasp, it makes a second effort. If this be not successful, it tries a third, a fourth, and even a fifth time. If it still fails, it stops and refuses to budge until the attendant gives it the missing thread.

With 24 miles of looms and 62 miles of whirling spinning-frame bobbins, to say nothing of pickers, drawing frames, rovers, and spoolers, and with an output of five hundred miles of cloth every working day, it is but natural that the Pacific Mills of Lawrence should require every device to prevent defective work. If a drawing frame did not stop as soon as a break in the sliver occurred, or a warper as soon as a thread pulled apart, or a loom as soon as a thread in the warp snapped, there would be defective material at every stage of the proceeding. So every strand passes through its own little guide, which consists of a tiny lever. The moment the thread breaks this lever is released, and by its own weight shuts off the power and stops the machine.

Our cloth is now woven. It is known as "gray" cloth in the mills, but at the dry-goods stores is called unbleached muslin. After careful inspection to locate imperfections, it is sent to the print works.

REMOVING THE FUZZ FROM CLOTH

Here it goes through another long series of operations. In the first place, it must be made into great rolls, like the paper for a newspaper press, so the ends of many pieces are sewed together. This makes possible the handling of many yards in one length. Many operations



STRETCHING CLOTH IN THE TENTER IN A MASSACHUSETTS PRINT WORKS

After the cloth has been printed, it is thoroughly dried, and then filled with steam, so as to make the colors "fast," or, paradoxically, to prevent them from "running." After that it is washed and dried again, then starched. Following the starching, it is put into the tenter frames. These are about one hundred feet long and have an endless chain on each side and steam pipes underneath. In them the cloth is dried and stretched to a uniform width.

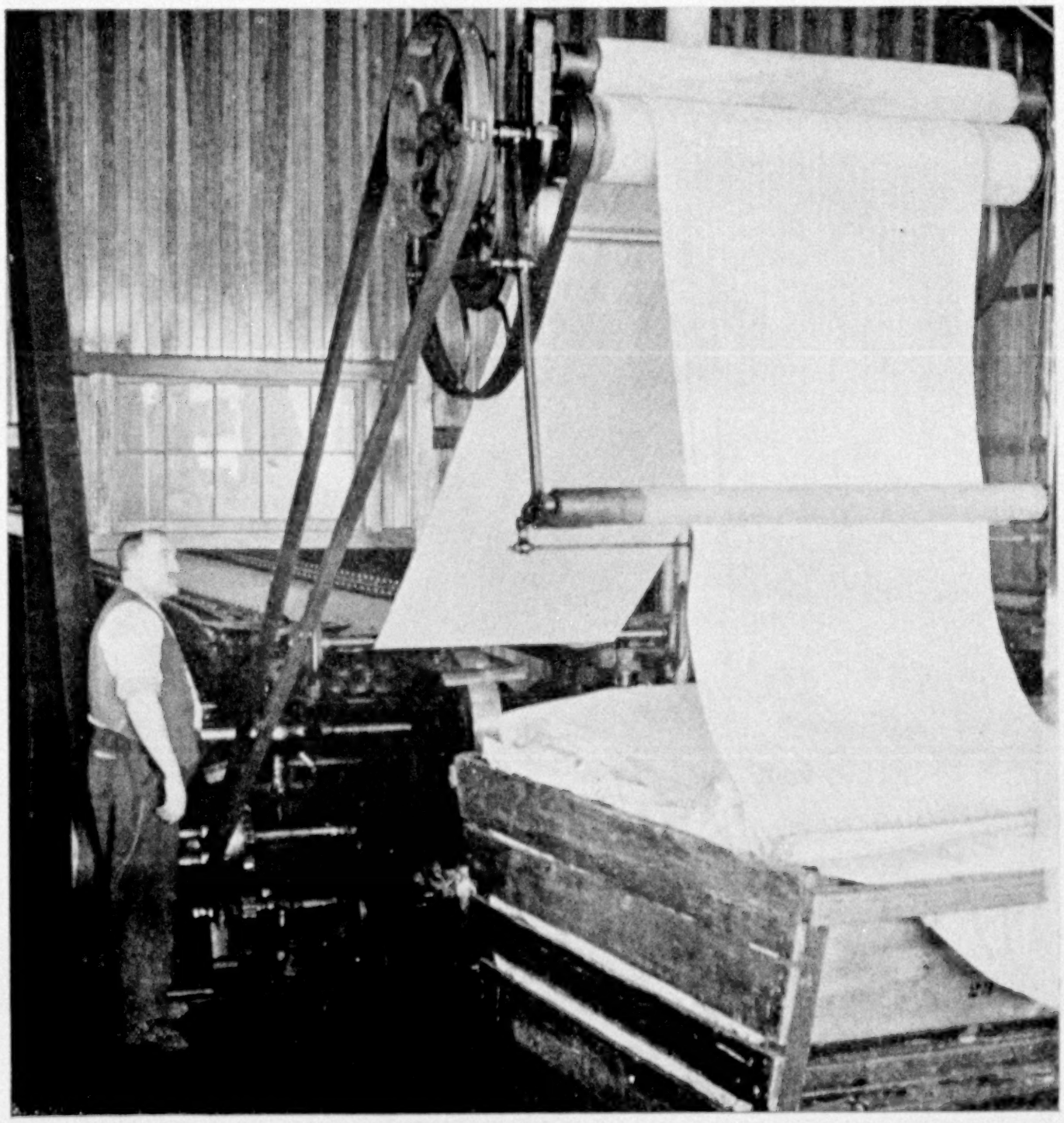
are continuous, and to stop often means waste.

As the cloth comes from the looms it has a loose fuzz all over the surface, and if the operators tried to print on it in that condition, they would get about the same result that is secured when trying to write on coarse, rough paper with a sharp-pointed pen—the lint adhering to the pen causes the ink to spread and make blotches. To overcome this the cloth is first put into a machine called the "cotton shear." This acts like a lawn-mower, clipping off all loose threads and knots and trimming the edges.

But still the lint adheres, and it must be removed before the cloth is in condition for printing. Whoever has watched a housewife singeing a chicken after picking it can understand both the reason for and the method of singeing the cloth. It is passed around rollers and through a gas flame at just such a speed that will allow the flames to burn off all the lint, but will not let it scorch the cloth.

From the singeing machine the cloth next goes to the bleaching kettles—kiers, as they are known in the print works. Here it is boiled for about twelve hours in a solution of caustic soda. Then it is washed and soaked for several hours in bins containing dilute acid, which takes out iron rust, stains, etc. It next gets another twelve hours of boiling, another washing, and another trip through a solution of bleaching powder. After that it is put into a pit and allowed to steep for several hours.

The effect is similar to the sun-bleaching on the grass out in the door yards of our grandmothers. It becomes pure white instead of dirty yellow, and more readily absorbs the dye when it goes through the printing machine. Once more it is washed



CLOTH BEING DELIVERED FROM THE TENTER TREATMENT

The cloth is laid out in neat folds by the swinging arm of this machine, vibrating back and forth. It is then taken to the presses, where it passes between heavy polished steel rollers and receives its ironing (see text, page 225)

and then dried by being drawn over copper drums filled with hot steam, after which it is wound into big rolls about the diameter of a large bass drum. It is now ready for printing.

Suppose our piece of calico is to be printed with a design of eight colors. Eight rollers are etched, and the eight pots of dye, or "color," mixed, the mixtures consisting of gums from Asia and Africa, starches from Iowa, and dyestuffs from everywhere, boiled and reduced to the consistency of glue.

The printing-machine is a large iron frame supporting a cylinder four or five feet wide. Arranged around it are the copper rollers, each ready to put on its color as the cylinder revolves, bearing the cloth to each in turn.

Each of the eight rollers runs in its own particular pan of color. A revolving brush spreads the color on the rollers,

FOLDING FINISHED PRINT GOODS: LAWRENCE, MASSACHUSETTS

Here the cloth is folded in layers a yard long. Forty yards make a bolt, and this is cut off and folded by hand. It is then ready for market.

and a sharp knife scrapes off all except that which is left in the little groove etched for the part in the pattern. As the roller comes into contact with the cloth the color is transferred to its proper place.

From roller to roller the cloth passes, until it has received its full assortment of colors, each in its exact place, and with the base color added last.

The color must be dried in the cloth, so it is passed over a series of steam-filled drums, then put into iron boxes filled with live steam.

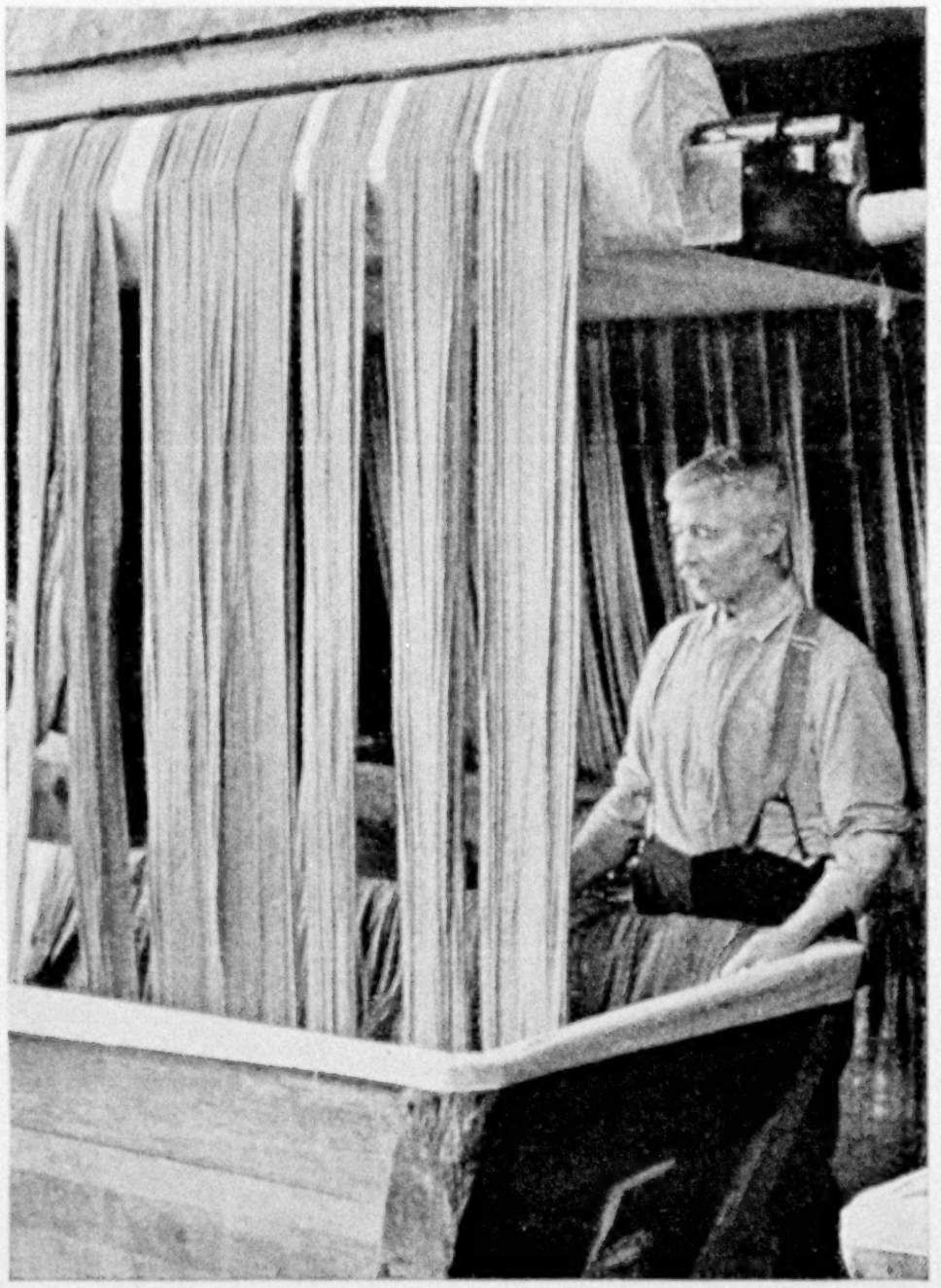
But even now your handful of cotton has not become your yard of calico. The cloth must be washed and dried and passed through boxes of hot starch.

It is put into a tenter-frame and stretched and dried. This frame is about a hundred feet long, underlaid with steam-pipes. On each side is an endless chain having clips which grip the edges and stretch the cloth to a uniform width.

Then follows the ironing process. To iron four or five million yards of cloth a week would be too much of a task for even a regiment of laundresses; so great presses having polished steel rollers are employed. They put a tremendous amount of mechanical "elbow grease" on the fabric, and as it comes through this final stage it is ready to make its bow as "finished" calico.

Finally, it is mechanically measured and cut into forty-yard lengths, after which it is folded into the shape one sees it in the dry-goods stores.

A long story, this converting cotton into calico! Forty different machines to pass through, for a kind of cloth that before the war became so cheap as to lose caste as dress goods.



DYEING CLOTH IN A LAWRENCE MILL

Goods are given their color in three ways: Some goods are dyed in the yarn, so that fancy patterns can be made by the weaving process. Others are dyed in the piece; these are solid color goods. Still others are printed by processes explained elsewhere in this article (see text, page 223).

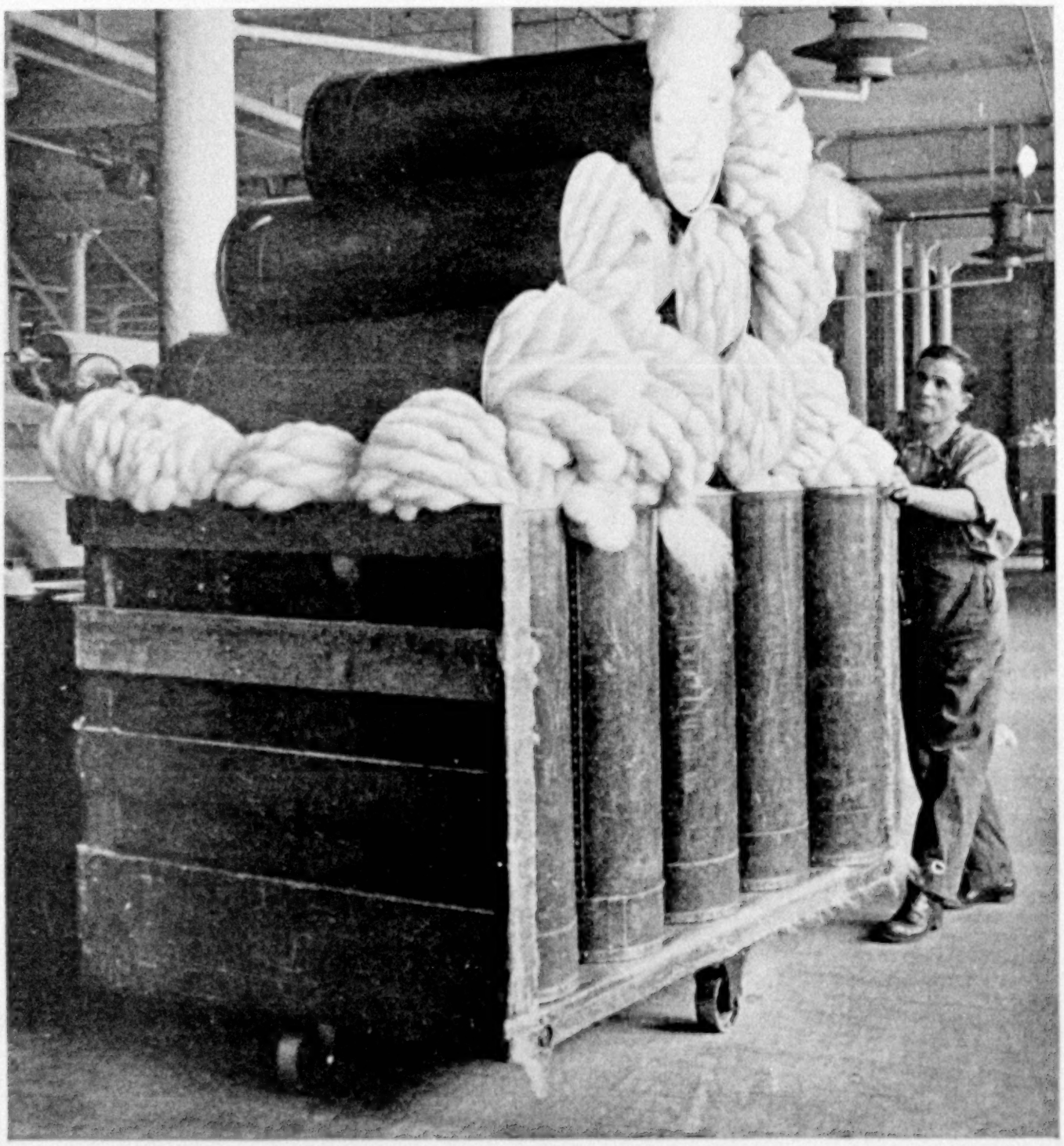
The processes of spinning yarn and weaving goods in the wool industry are not dissimilar to those employed in the cotton mills, though the preparation of the wool is different in that before it can be used it must first be scoured to get the grease out of it.

The total output of the looms of Massachusetts, in pure woolens, amounts to about 115,000,000 square yards a year—enough to make a blanket a mile wide and thirty-seven miles long. This is more than a third of all the woolens made in the United States. In addition, the State produces almost as much more goods that are either a mixture of cotton and wool or have cotton warp and wool filling.

Silk differs from cotton and wool in its preparation, in that it is a long thread and not a short fiber. In the article entitled "The Industrial Titan of America," in the May, 1919, number of THE GEOGRAPHIC, the story of silk up to the weaving stage was told.

MASSACHUSETTS SILKS

Holyoke, Massachusetts, is the home of what is perhaps the purest silk goods made in America. Though the prices of raw silk have risen from $4 to $12 a

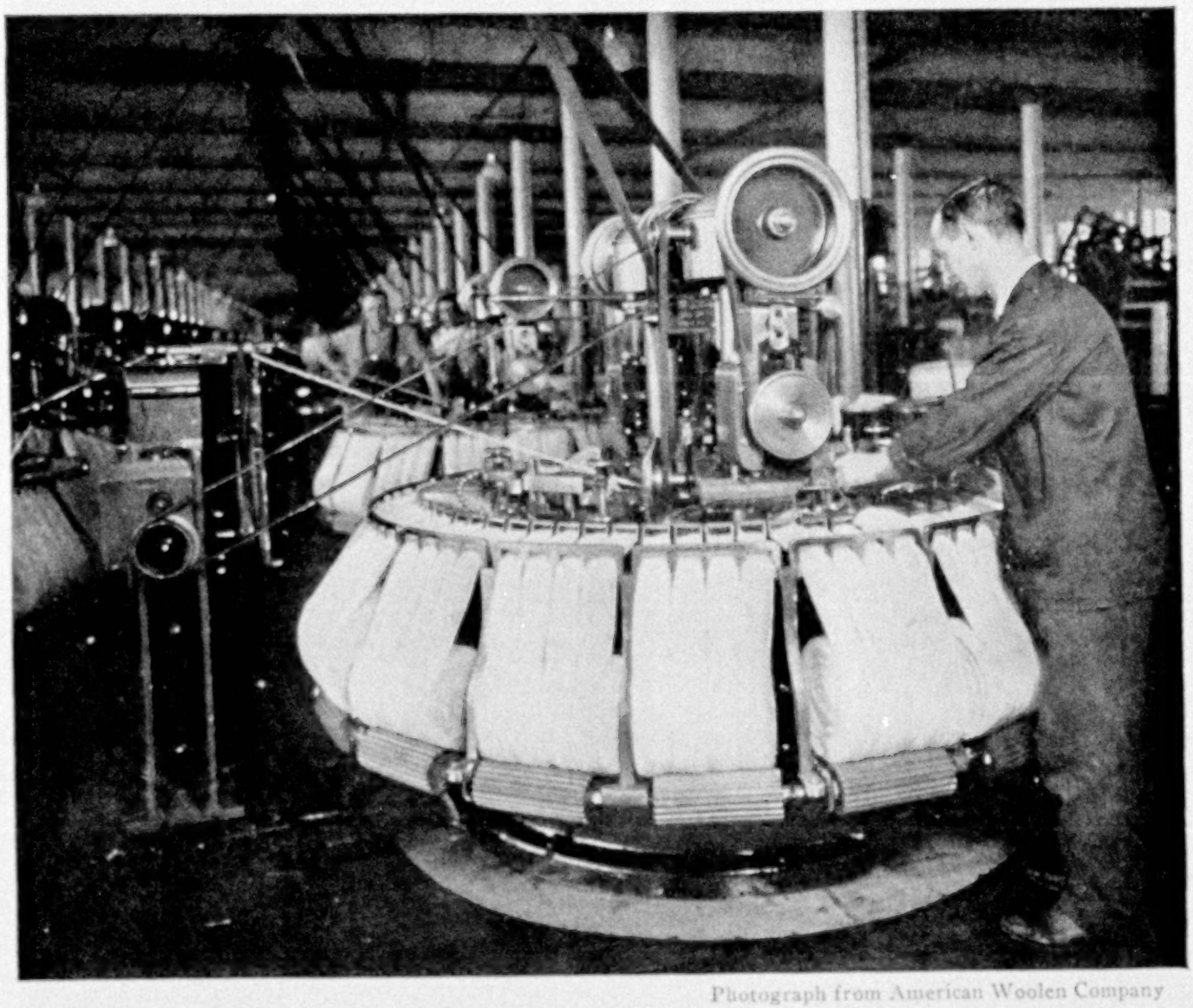


CARDED WOOL IN A MASSACHUSETTS WOOLEN FACTORY

There are two objects in combing wool: first, to straighten the fibers and lay them parallel to one another, and, second, to eliminate the short fibers. The long fibers are used in the higher-grade yarns.

pound, and the temptation everywhere is to "load" it with tin, so that much of the silk goods one buys today has more metal than fiber in it, and consequently "cuts" and wilts away in a manner very disappointing to the wearer, a few manufacturers still adhere to the production of "unweighted" silks.

Pure silk is one of the most durable of all cloths. One may judge of its lasting qualities from the experience of a Massachusetts manufacturer whose silks are known everywhere. A half century ago his little mill, nestling close to the eastern slope of the Berkshire Hills, was caught in a flood that carried it away. To this day little bobbins of the silk from that mill are sometimes upturned by the plows of the farmers in the valley below. The wood of the bobbin has rotted away, but the silk fiber remains as strong as the day it was wound.



Photograph from American Woolen Company

A WOOL-COMBING MACHINE IN OPERATION

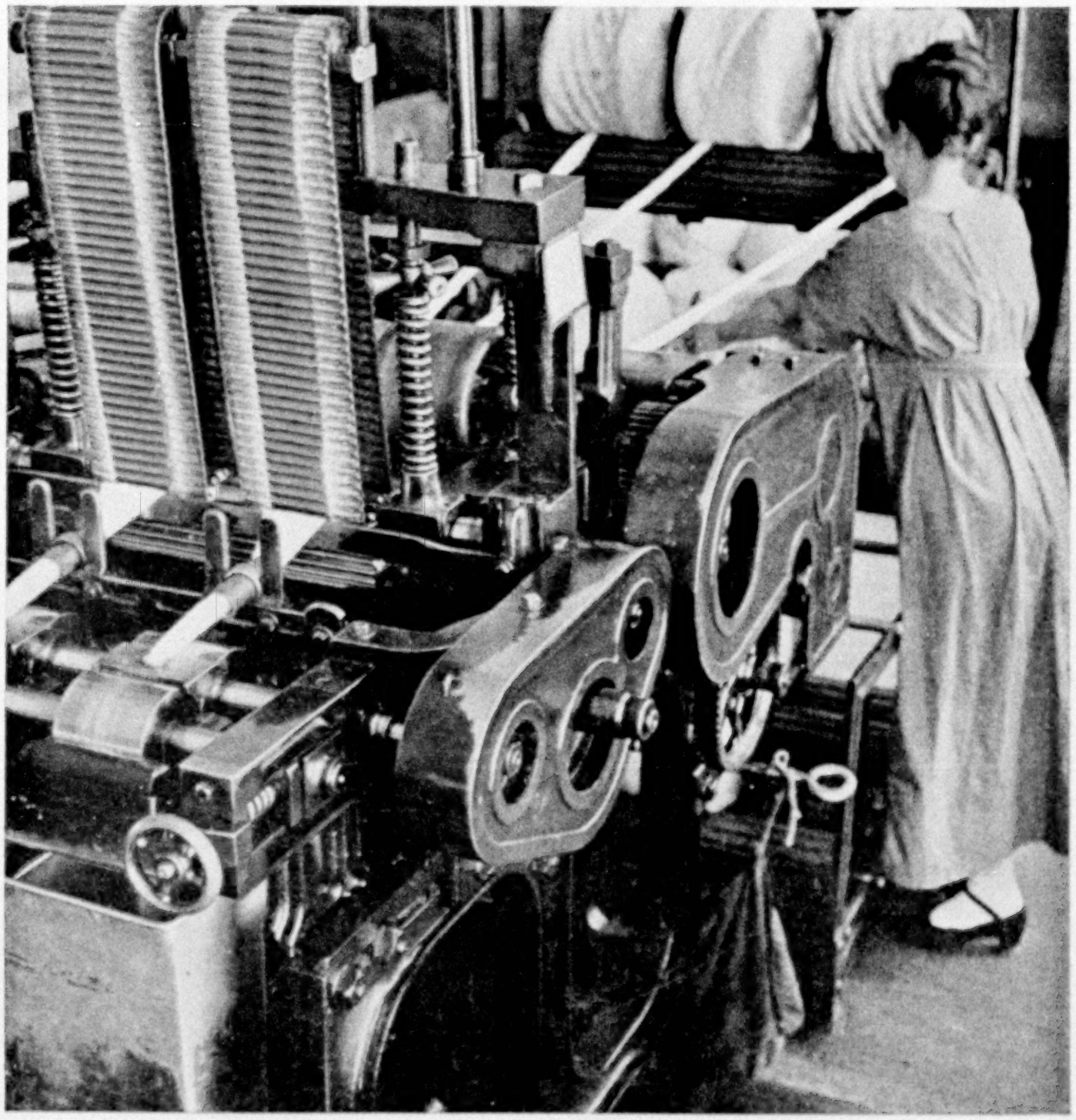
Here the fibers are being combed out and placed parallel, ready for the twisting that converts wool into yarn.

Do pure silks cost much in these days of skyrocketing prices? With the raw silk at $12 a pound and the throwing, dyeing, and weaving all done by wage-earners who command the best wages paid in the entire textile industry, it could hardly be otherwise. But the woman who demands the silk as the worm spun it never knows what it is to have silk "cut." She can distinguish the pure from the "loaded" silk by the simple test of putting a match to a tiny piece of it. If it burns quickly and cleanly, leaving a soft, grayish-black ash, it is pure silk. If it smoulders like punk, leaving a red, gritty ash, it is "loaded" with tin.

ENOUGH SHOES TO COVER 1,000 ACRES

The American people would either be a very poorly shod folk or else would have to import vast quantities of footwear, if it were not for Massachusetts. Two out of every five Americans one meets are shod with Bay State shoe leather. The men of the nation wear more shoes than the women, and the factories of the Pilgrim Commonwealth produce proportionately more shoes for men. If all the shoes manufactured in the Bay State every year were set side by side and end to end, they would cover nearly a thousand acres of ground.

To satisfy the demands for footwear, Massachusetts has to make heavy drafts upon the animal world. The shoe manufacturers of the State usually carry in stock the skins of more than 135,000 kangaroos and wallabies and a third of a million high-grade sheepskins. Nearly 3,000,000 goats and kids go to the slaugh-



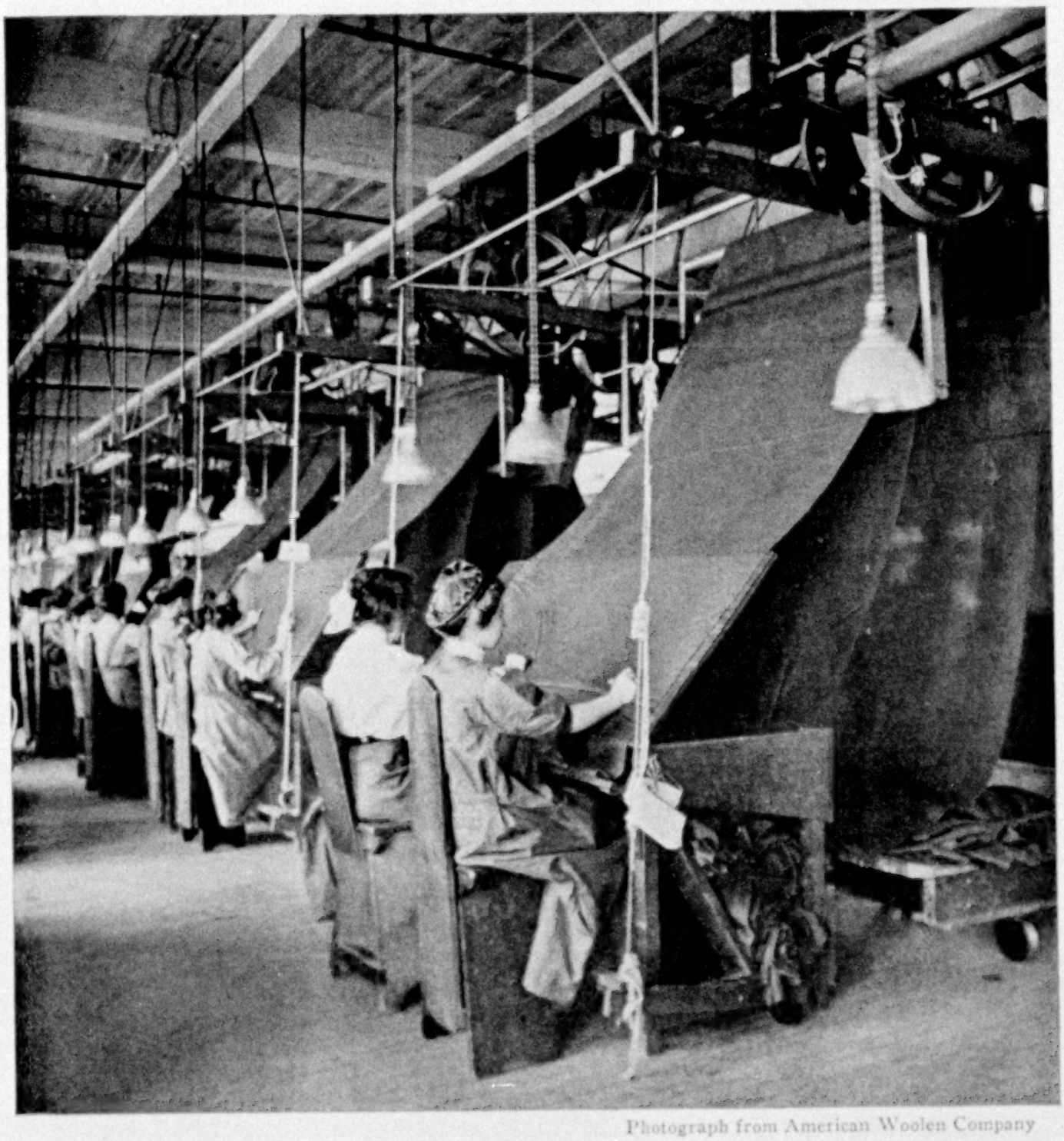
"DRAWING" WOOL IN A LAWRENCE WOOLEN MILL

In the transformation of combed wool into unspun yarn it is passed through from six to nine machines, each of which unites many slivers of its predecessor into one of its own. For instance, in the first machine six slivers are united into one, stretching one yard into eight yards. In each drawing that follows a number of the next preceding slivers are consolidated into one and drawn out, so it often happens that a single strand of worsted yarn is the consolidated and drawn-out product of hundreds of thousands of original slivers as they came from the wool-combing machine. One inch of original sliver may share in the making of several miles of thread.

ter pen every twelve months to give milady shoes for her dainty feet. A million ordinary sheep and lamb skins and as many more calfskins represent the normal stock of Massachusetts manufacturers, to say nothing of the thousands of hides that come from cattle and horses.

It is a far cry from the village cobbler who pegged his life away over his lasts to the Massachusetts factory with its thousands of hands, its scores of processes, its dozens of kinds of machines, and its millions of shoes.

At Brockton one may see more shoes



Photograph from American Woolen Company

INSPECTING THE FINISHED CLOTH IN A WOOLEN MILL

In weaving it is inevitable that threads occasionally break and that knots appear. Expert menders go over the cloth yard by yard and mile by mile, with eagle eyes, for defects that they mend with astonishing speed and skill.

being made than in any other city on the globe. It is interesting to journey there and see how modern men are shod.

First of all, it will be discovered that Brockton is preëminently the man's shoe town. Lynn claims first place in the manufacture of woman's shoes, and Haverhill prides itself upon being the slipper city of the world.

Being the greatest shoe-wearing as well as the leading shoe-producing country in the world, the American market is such a large one that not only do cities specialize in types of shoes, but manufacturers carry the specialization even further. Massachusetts makes more shoes than Great Britain or Germany and has an export trade that reaches ninety countries and colonies.

Following a stream of shoes through a factory from uncut leather to ready-to-wear product may be rather a long ram-

Photograph by Leon H. Abdalian

CUTTING "UPPERS" SHOE LEATHER IN A MASSACHUSETTS FACTORY

The average American wears three pairs of shoes a year. Massachusetts makes nearly half of them. For the pedigree of a shoe see text below.

ble, but the trip shows to what perfection the Yankee shoemaker has carried the art of quantity production.

FOLLOWING A SHOE THROUGH A BROCKTON FACTORY

Before going on this pilgrimage, which is in a factory making a specialty of welt shoes, it must be remembered that there are four general types of footwear, according to the manner in which the soles are attached to the "uppers." The leading type is the welt. It has a small strip of leather sewed fast, first to the upper, and then to the sole, so that upper and sole are not joined directly. Welt soles are used mainly in higher-grade men's and boys' shoes and in women's walking shoes.

The McKay sewed shoe is the second type. In it the sole is sewed directly to the upper. The cheaper grades of stiff-soled sewed shoes are made by this method.

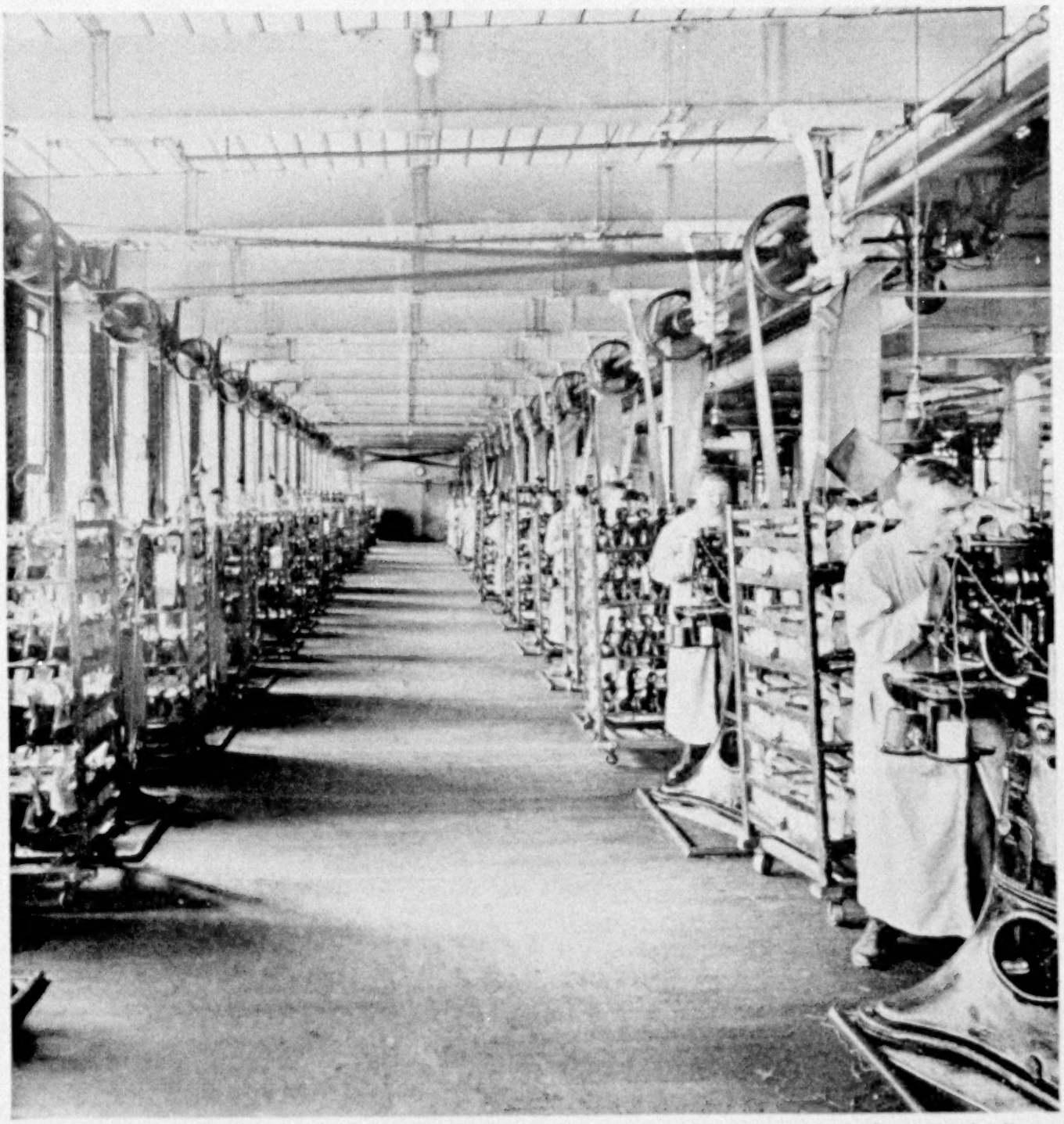
The turned shoe is the third type. In it the sole is joined to the upper with the whole shoe inside out, then turned. Women's pliable-soled shoes are made in this fashion.

The nailed, pegged, or screwed-on sole represents the fourth type and goes with cheaper grades of shoes.

A merchant in Bethesda, Maryland, say, has sent to the factory we are to visit an order for ten dozen pairs of shoes. After the order is entered upon the records four sets of tags are made out. One set goes to the uppers material department, another to the uppers stitching department, the third to the sole-leather department, and the fourth to the making department.

A MASTER HIDE-MEASURING MACHINE

As uppers leather comes into the factory it has the irregular outlines of a hide or skin, as indented as the coast of Maine, and by hand could be measured only by a master of trigonometry, through a long process of calculations, but a machine



Photograph by Leon H. Abdalian

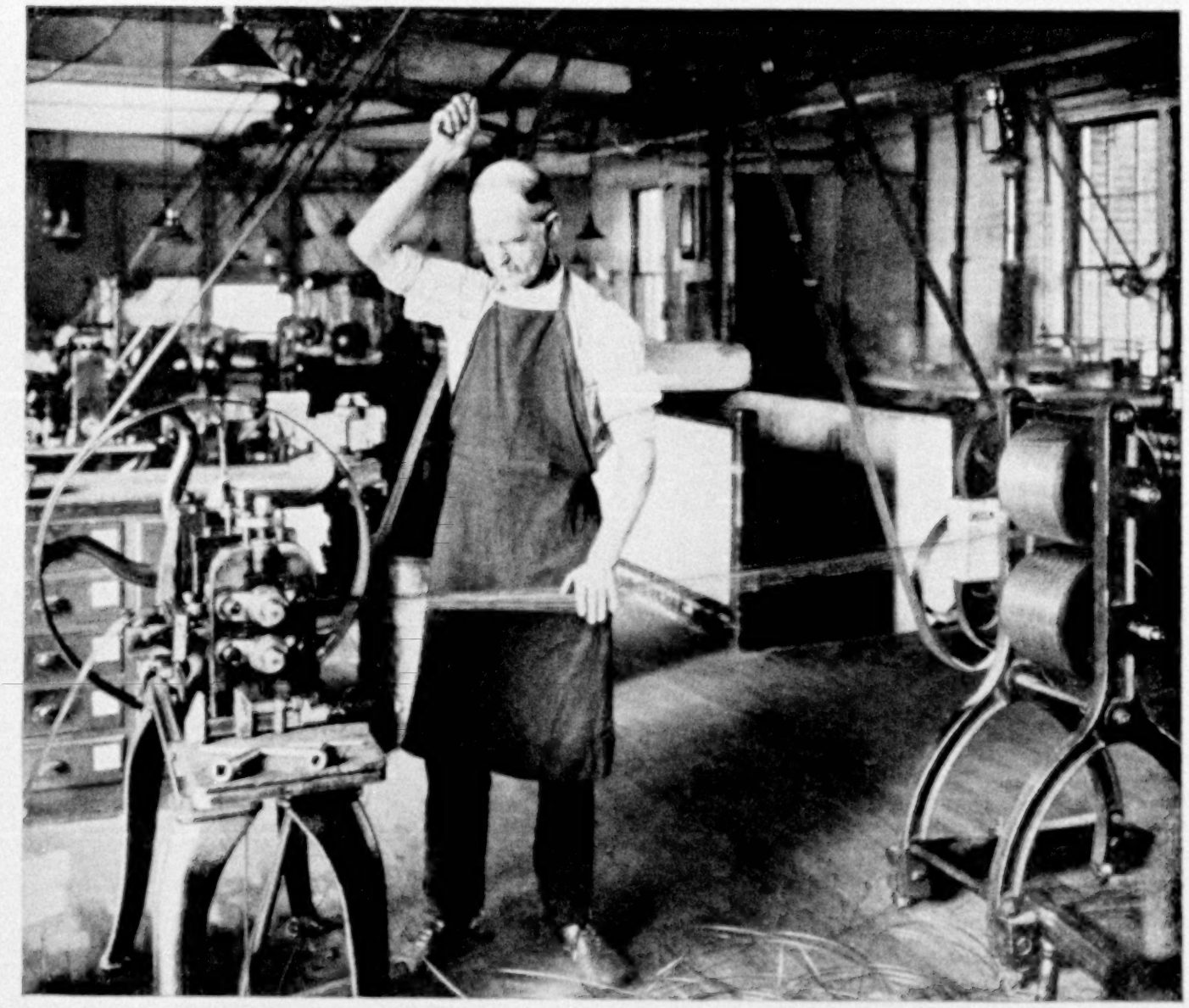
WHERE "UPPERS" MEET AND ARE JOINED TO THEIR "SOLE-MATES" IN A SHOE FACTORY

If all the American people wore hand-made shoes, as they did in Washington's time, at least two million men would be required to keep the nation shod.

has been invented that can calculate more areas in half a minute than a mathematician could in half a day. The hide or skin is fed through this device as cloth through a clothes-wringer, and a hand on a dial above points to the number of square feet in it, just as the hand on a catch-penny weighing-machine points to the number of pounds the person on the platform weighs.

"How much leather does this skin contain?" queries the operator, in effect. "Zip, zip, zip," it answers, as its pointer turns to 9.9 feet. Saying "Jack Robinson" takes longer than measuring a hide in this factory. The machine is so delicate that it has to be adjusted to temperature every day.

It would be tedious to note every person engaged, every machine, and every process in the making of a pair of shoes, for that would introduce fifty machines, a



Photograph from Waltham Watch Company

CUTTING MAINSPRINGS IN A MASSACHUSETTS WATCH FACTORY

A single Massachusetts factory makes fourteen tons of these tiny springs a year. The variation of even 1/500 of an inch in the thickness of the mainspring will affect the time-keeping qualities of a good watch.

hundred people, and two hundred processes, and serve to confuse the most patient reader, so only the salient features of the shoe's journey through the factory will claim attention.

In the linings department are big machines that cut uppers cloth, twenty to forty thicknesses at a clip, as easily as a cake-cutter cuts dough.

Beyond is the uppers leather department. Here a trained man, with stubby bladed, razor-edge knife, takes the skin, lays it on his cutting board, and, running his knife around his several aluminum patterns, cuts out vamp and quarter and toe piece with accomplished art in getting the maximum of pieces out of the minimum of skins. When he has finished with a skin it looks like shapeless strings bordering a series of irregular holes.

In cheaper grades of shoes the leather also is cut by "dinking" machines—mechanical cake-cutters applied to shoemaking. Only one ply is cut at a time, but there are series of dies for the different parts.

After the quarters, vamps, toe caps, etc., have been cut the leather must be "skived," so as to prevent any raw edges showing in the finished shoe. The edges are fed through a machine that shaves the unfinished side down to a bevel. This is then covered with cement and the thin edges folded over, much as a seamstress lays a hem.

There are some twenty-odd parts in

Photograph by Leon H. Abdalian

REPAIRING BALANCE-WHEELS IN A MASSACHUSETTS WATCH FACTORY

The balance-wheel must divide time correctly, to the infinitesimal fraction of a second. It plies back and forth nearly half a million times a day. To make one of these wheels requires some six hundred detailed operations.

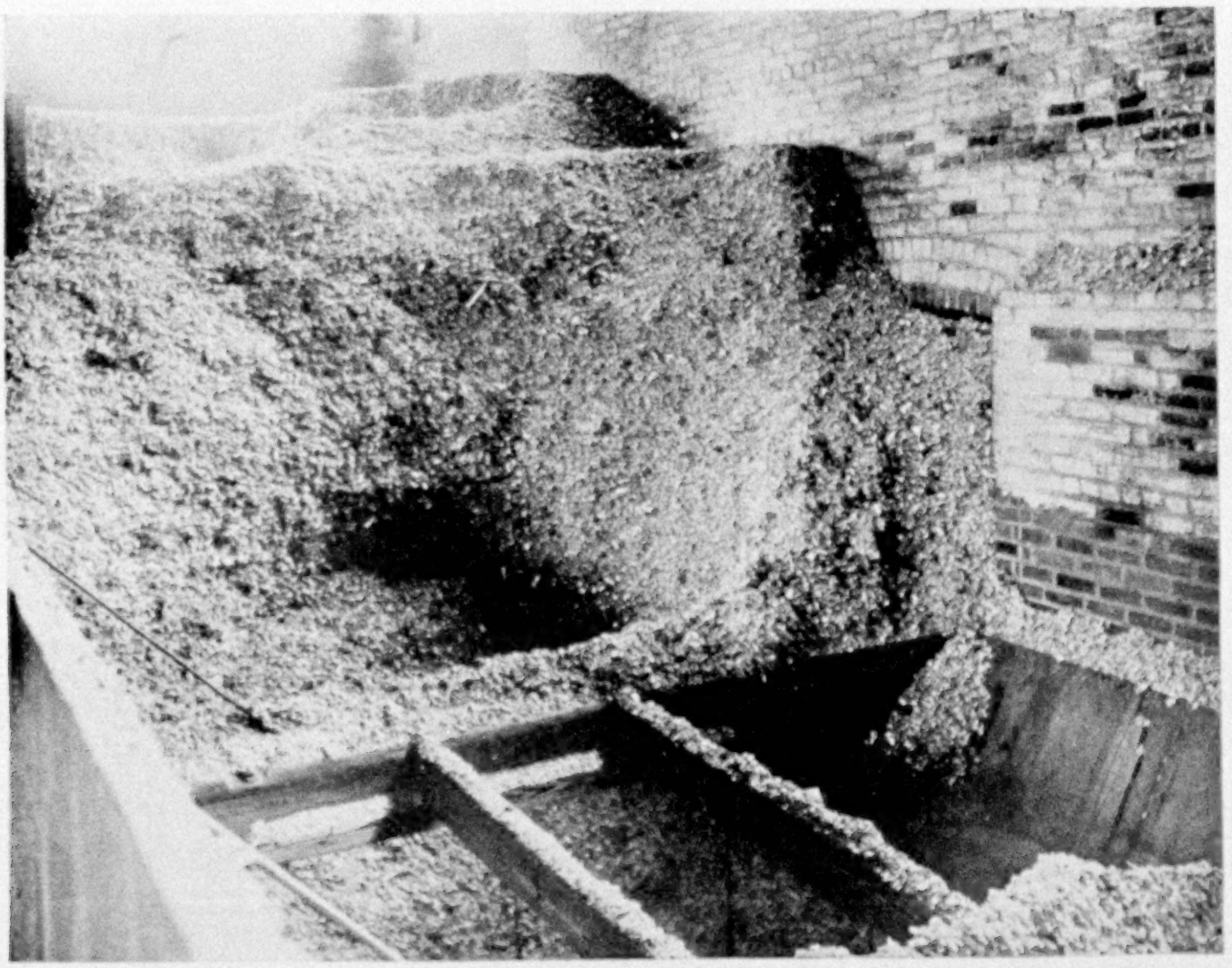
the upper of a button shoe and more in a lace shoe. To have each bit of lining and each piece of leather meet its respective seam-fellow and counterpart, at the proper moment, in the stitching department, is a task for the organizer.

The linings go from the assembly room to be transformed from individual pieces into the canvas counterpart of the leather upper. The quarters are joined at the back and stayed with a reinforcement. The vamps are cemented into shape ready for inclusion in the finished upper.

The tips go to the toe-cap room, where they are perforated at the edge to give them a pleasing appearance on the foot of the wearer. Fourteen different processes are required to transform a piece of tip leather into a finished cap, with

RAW MATERIAL FOR THE GEOGRAPHIC MAGAZINE

The mills of the Champion-International Company which make paper on which the NATIONAL GEOGRAPHIC MAGAZINE is printed are located in Lawrence, Mass. This picture shows great piles of pulp-wood ready for conversion into paper for THE GEOGRAPHIC. Parts of these wood piles are more than 50 feet high. The cars shown in the picture are on a trestle 21 feet high. The GEOGRAPHIC magazines mailed in a single year, if laid side by side, would reach from Quito, Ecuador, across Colombia and the Caribbean, thence across the United States and Canada, through the North Pole, and across Siberia, China, and Siam to Bangkok. It takes 33,000 miles of wrappers to mail one year's edition. It would require a bookshelf more than three and a half miles long to hold all the copies of this month's issue of THE GEOGRAPHIC.



GEOGRAPHIC PAPER MATERIAL READY FOR CONVERSION INTO PULP

The wood from which THE GEOGRAPHIC paper is made is first converted into chips. It is then put into huge steel digesters, where, with the use of chemicals and under a high steam pressure, it is converted into pulp, much as the juices of the stomach digest food. The digesters are directly under these bins, and are filled by pulling a slide at the bottom of the bins. Both acids and alkalis are used in converting wood into pulp. In general practice, sulphurous acid is used in treating the long-leaf, coniferous woods, having the longer fibers, such as spruce, hemlock, and fir, and caustic soda in treating the broad-leaf woods, such as poplar and chestnut, having the shorter fibers.

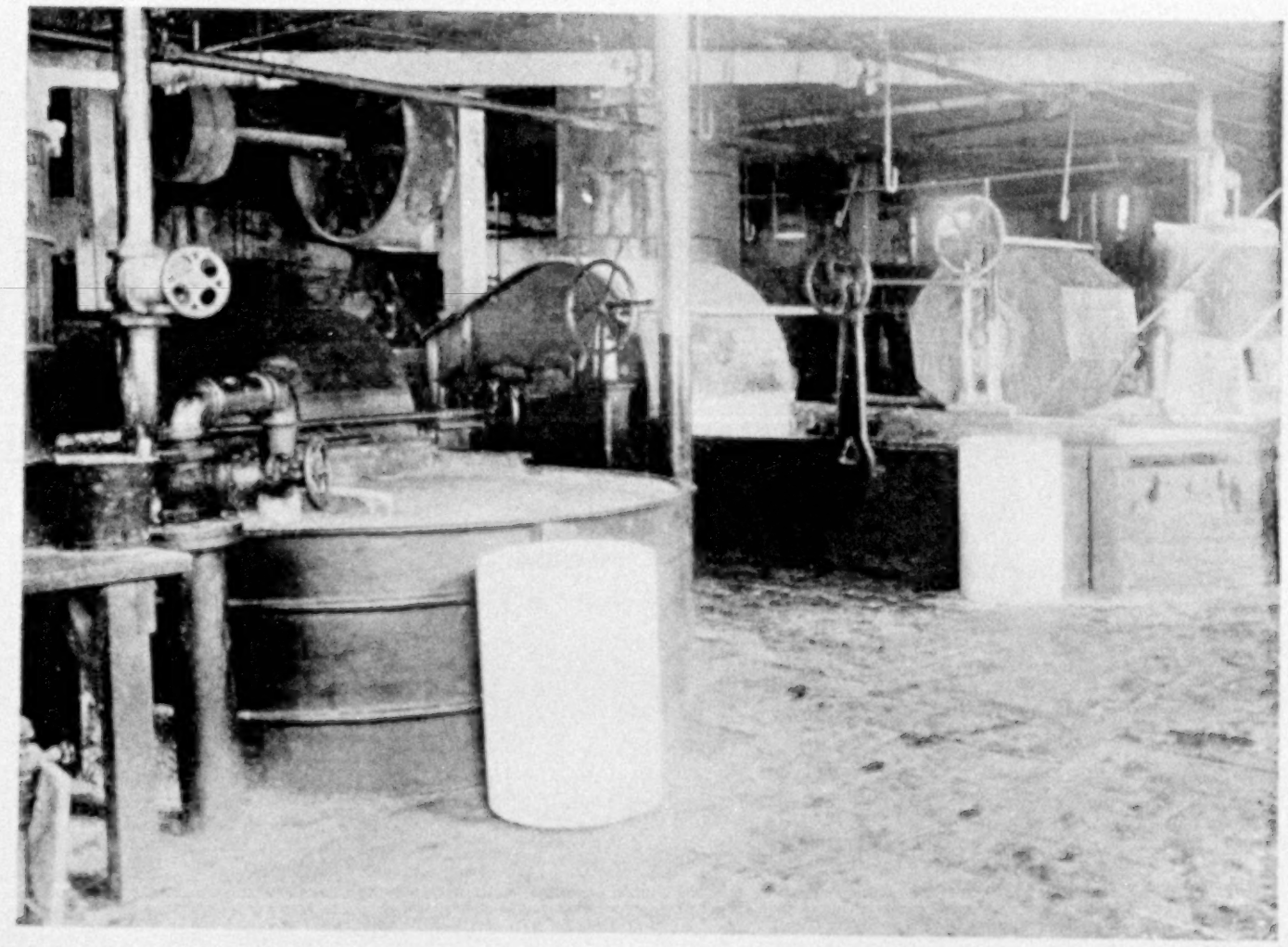
its box to hold the shape of the shoe and canvas lining to protect the hose of the wearer.

It is interesting to pause in the buttonhole department and there watch a machine cutting and working buttonholes in one operation, and another putting the eyelets and hooks in a shoe more quickly than one can tell about it.

The next step in the journey is that of joining the quarters and vamp. This must be done with great care, so that there is neither unevenness nor roughness. It is the most difficult task in the making of the upper of a shoe. Judgment and care are required and much strength of hand. Other minor processes follow, and presently the finished upper fares forth to meet its sole-mate in the making department. Before it goes, if it be a laced upper, a girl puts it through a machine that laces it up and ties it in the twinkling of an eye—a machine that would be a glorious aid to a fat man.

JOINING THE UPPER TO THE SOLE

Preparatory to its alliance with the sole, the upper is lasted. The insole has been tacked on the last, and the upper is now pulled tightly over the last with a machine that has pincers which act like human fingers. They draw the whole upper in tightly over the last, so that there is not a wrinkle left, and tack it down on the bottom. The toe and heel



A CORNER OF THE BEATER-ROOM, WHERE THE DIGESTED WOOD IS FURTHER TREATED BEFORE BECOMING READY FOR CONVERSION INTO PAPER

In this room digested spruce wood, treated with sulphur fumes, and digested poplar wood, treated with caustic soda, are mixed—the one to give strength and the other bulk to the paper, long-fibered wood making strong paper just as long-staple cotton makes strong cloth. Clay, used for filler, and other materials are then added, and the mass is thoroughly beaten and mixed and brought to a proper consistency for use in the paper-making machines.

require a little extra attention and are held down by a piece of fine wire.

The lasted shoe next goes through a trimming machine that removes all surplus leather, while a mechanical hammer pounds the leather smooth. Then it goes to another machine, where the toes and heels are beaten smooth, making the shoe ready for welting.

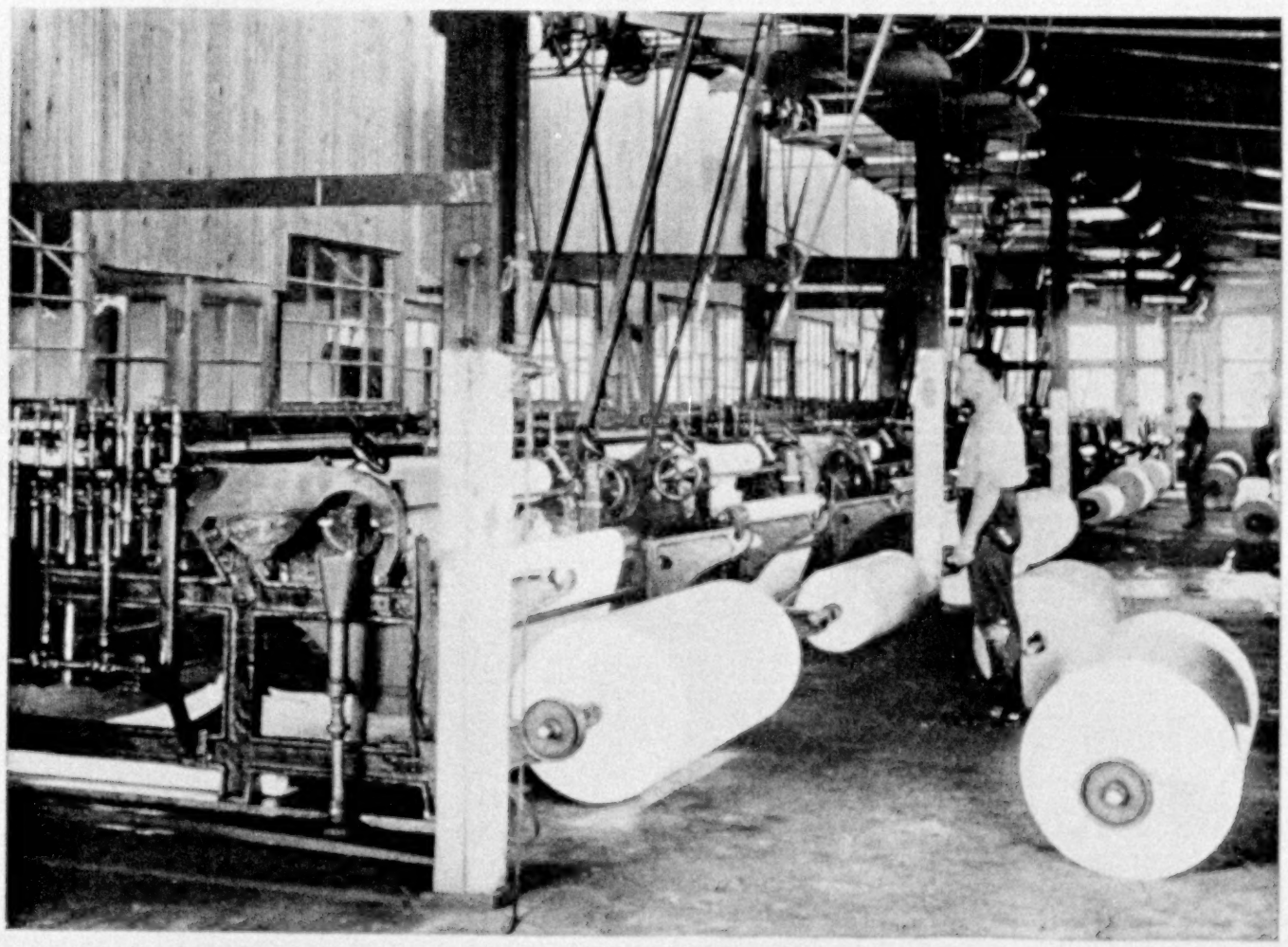
The welt is so prepared that it can be sewed to the insole and the upper in one sewing, and later have the outsole sewed to it. After the joining of insole and upper to the welt, the shoe is passed through the inseam trimming-machine. Next it goes to a machine where a small hammer gives the welt a terrific beating. The insole and welt are then covered with rubber cement, as is the waiting sole. When this has dried slightly, the sole is laid on and the shoe is put into a pressing-machine, where the cement dries.

Next it goes to the rough rounding-machine, which rounds sole and welt, allowing them to extend out from the upper at all points. Looking at the shoe on your foot, you will see that this extension is less at the shank than at the ball, and less on the outer side than on the inner side of the foot. The rough rounding-machine also cuts a little groove around the bottom of the sole for the purpose of receiving and covering the stitching, to follow. The welt extends back only to the heel. The latter has no welt, but is stitched directly and has its own special treatment.

One could write much more telling of the preparation of the soles; how they are rolled under tremendous pressure to

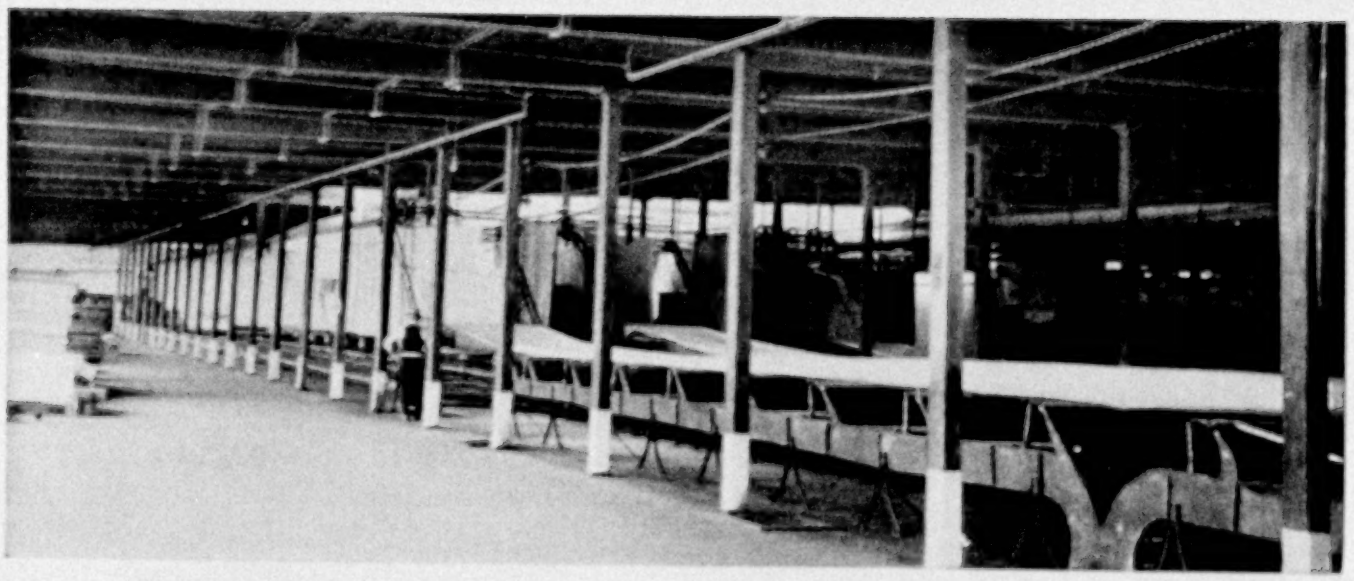
NATIONAL GEOGRAPHIC PAPER IN THE MAKING

In this large room, some two hundred feet long, the liquid pulp shown in the previous picture is converted into uncoated paper. At the rear of each machine is a tank of the pulp. A film of this pulp flows out upon an endless belt of fine-meshed wire, which is shaken vigorously. The water drops through the wire and gradually the residue solidifies. By the time the endless belt reaches the returning point, this residue is solid enough to hold its form as paper. It is then caught up between two rolls, which squeeze out the remaining water. Thence it passes around a series of iron drums filled with live steam; these dry it. After that it passes between big calender rolls and emerges in the foreground as machine-finish paper, ready for the coating or glazing process. These machines give one an idea of the huge proportions of a modern paper plant.



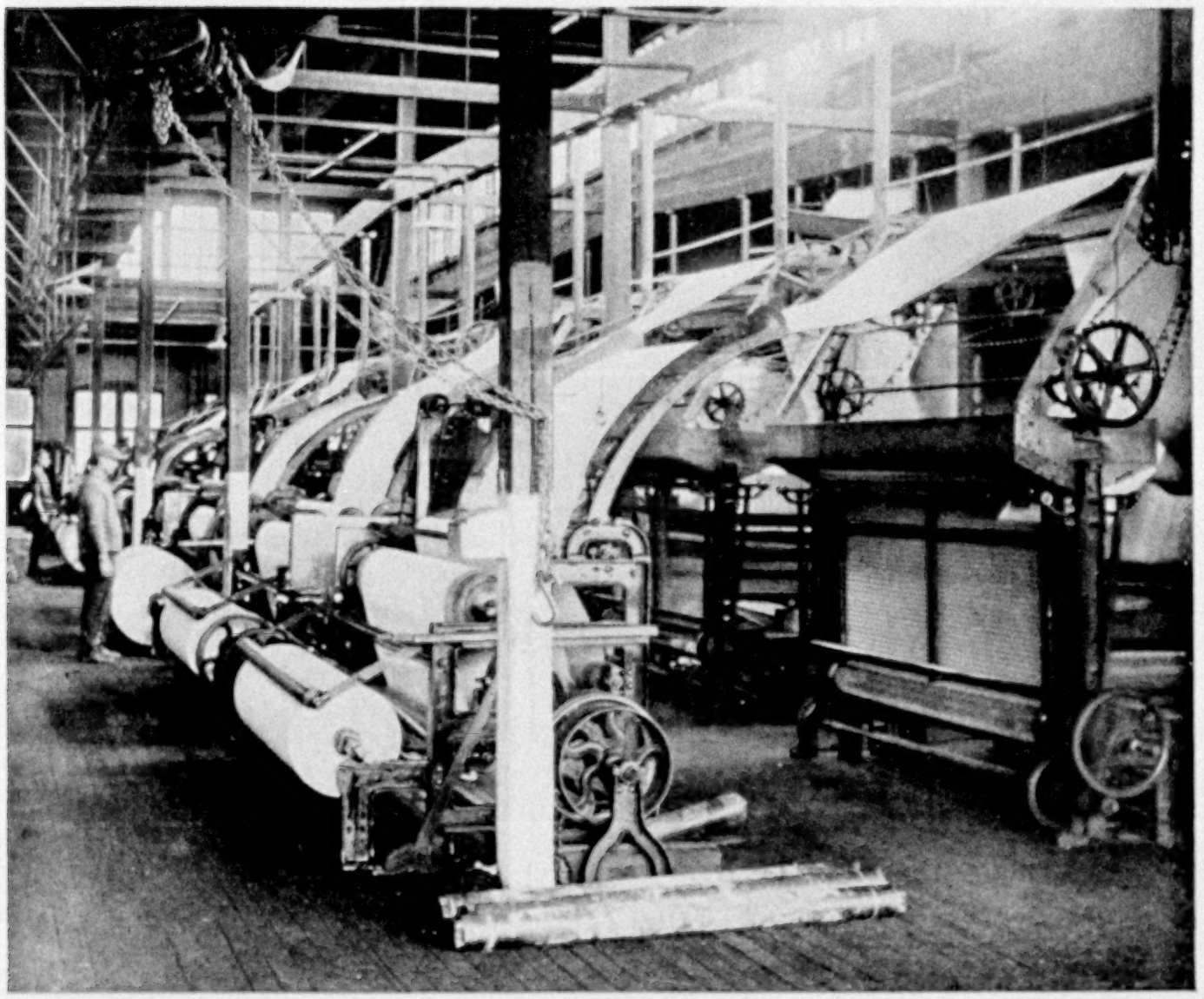
IN THE COATING-ROOM

This picture shows the rolls of paper made on the machine shown on page 237, just starting on the coating-machines. The paper passes through a bath of coating material; then through felt-covered rolls; then between vibrating brushes, which lay the coating material evenly and smoothly on the paper. It then passes out at the left into the drying-room (see following illustration).



THE DRYING-ROOM IN THE COATING MILL AT LAWRENCE, MASS.

After the paper has received its coating from the coating-machine shown in the previous picture, it passes in a continuous web to the drying-room. Blasts of hot air coming out of galvanized ducts beneath support it for a distance of 100 feet, until it reaches the drying-chamber in the rear of the room. Here it hangs in festoons much like those of cotton cloth shown on page 219. In the picture the paper is passing from right to left. After leaving the drying-room it is wound on rolls, as shown in the next picture.



PAPER READY FOR THE CALENDER PRESSES

This picture shows the paper after it has been coated and dried, as shown on page 238, and is being rolled at the end of the coating-machine. It is now ready to be sent to the big presses which calender it (or iron it, as popular parlance would have it). The pictures on pages 238 and 239 show a continuous process over a single machine; but, on account of the length of the machine, the process is illustrated in sections.

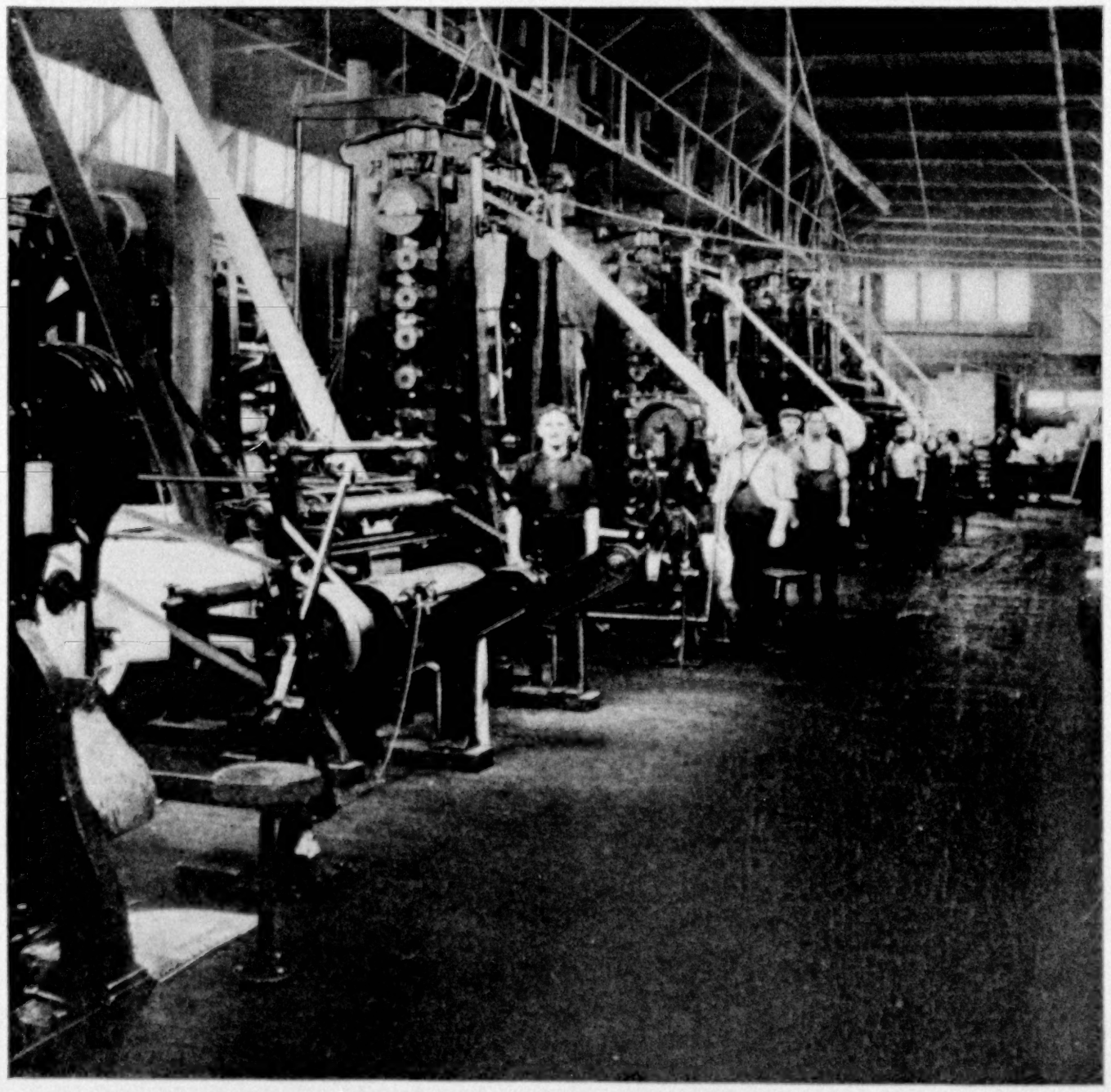
solidify the leather, just as the village cobbler beats them under his wide-faced hammer; or of the heeling-machine, that sets the heel in place and drives all of the nails at one operation; or of the counter-making machines, that give stiffness to the spur piece of the heel.

One shoe factory in Massachusetts has a daily output of 14,000 pairs, each pair marching through the factory in fourteen days in ordinary times.

THE PECULIAR LANGUAGE OF THE SHOE FACTORY

The industry has its own peculiar parlance. A "cripple girl" is not crippled at all. Rather she looks after the "cripples," as defective parts of a shoe are known. "Vamping" has nothing whatever to do with the activities of sirens, but is only the process of joining the vamps and quarters to the shoe. "Blackball" doesn't relate to club proceedings, but rather to a mixture of grease and lampblack for blacking the edges of shoe soles. A "cack" is an infant's shoe, and a "pac" a duplicate of an Indian moccasin. An "iron" is a unit of thickness in sole leather, and a "lift" is one thickness of leather in the heel. A "nullifier" is a shoe for house wear, having a high vamp and quarter, dropping low at the sides, with a short rubber goring.

It would be idle to attempt in a few paragraphs to describe the hundreds of processes and the scores of intricate



A BATTERY OF CALENDER PRESSES AT WORK FINISHING MAGAZINE PAPER

After the coated paper has been dried and put into rolls, as shown in the preceding pictures, it is brought to the room shown here. A roll is put in the reel at the man's shoulder in the foreground and started through the machine. It passes between the two top rollers, and then in and out between the succeeding rollers, until it reaches the bottom. Many tons' pressure have ironed it before it comes out and is rolled up again. This process gives it the finish that the NATIONAL GEOGRAPHIC must have to maintain its high standard.

machines employed in the making of watches; but to visit a great Massachusetts watch factory and there to see some of the operations of making a good timepiece is to behold the highest development in mechanical accuracy and quantity production.

STEEL HAIRSPRINGS WORTH $49,000 A POUND

Here one sees alloy steel wire worth five dollars a pound being converted into hairsprings, some so delicate that they are worth $49,000 a pound. There a machine is taking in steel wire and turning out microscopic screws with perfect heads and threads and slots, yet so small that the ordinary eye wants a magnifying glass to perceive that they are aught but specks of steel. In another place is a machine which transforms bare blanks into completely bored movement plates without the interposition of a human hand.

THE ASSORTING-ROOM IN THE PAPER MILL

After the paper has been calendered, the big rolls are put into a cutting-machine that cuts the continuous roll into sheets of the desired size. These are then examined, sheet by sheet, by the women shown in the picture. All perfect sheets are put into one pile and the imperfect ones are placed in another pile. The perfect sheets are then ready, after trimming, for the presses of the NATIONAL GEOGRAPHIC.

To see a skilled hairspring-maker take three little pieces of flat wire and coil them together with the aid of a pencil-like rod slotted at the end, putting the coil into a tiny copper case just large enough for the reception of the untempered spring, looks so easy that one thinks that anybody could do it; but on the day that a GEOGRAPHIC representative was studying the factory in question the foreman of the department in charge of hairsprings said to the secretary of the establishment, "I took two new girls on yesterday. One of them got one spring wound yesterday and one today, but the other has not succeeded in getting a single spring into the tempering box." Yet so skilled do the women spring-winders become that an expert can finish one every few minutes.

There are three slots in the end of the winder. Into one of these goes the alloy steel wire that is to constitute the hairspring. Into the others go soft steel wires of corresponding dimensions. Between the steel wires is sandwiched the one of alloy.

The little copper boxes are then sent to the annealing furnace and heat-treated. When this process is finished the soft wires are thrown away, leaving the alloy wire a perfectly wrought hairspring, the price of the smallest of which is seven dollars a dozen, or more than a hundred times their weight in gold.

SCREWS SO SMALL THAT 50,000 MAKE A THIMBLEFUL

But, tiny as they are, these infinitesimal springs must impart to the balance-wheels of the watches they regulate 432,000 impulses a day, and must measure time correctly, down to an astonishingly small fraction.

The machine that makes the tiny watch screw is a marvel of mechanism. In the morning it is given a long steel rod of small diameter, and is then left to its own resources. Now a tiny section is turned into the shape of a finished screw; then the thread is cut; next the slot is cut in the head, and finally a mechanical hand deposits it in a bath of oil, where it stays until fished out with a tiny steel net like a tea-strainer. A sharp eye is required to recognize it as a screw. It would take 50,000 of them to make a thimbleful.

A WIZARD OF MACHINERY

The most dramatic machine in this veritable maze of intricate and wonder-working mechanisms is that which makes the lower movement plates.

On one side is a magnified dime savings bank, mounted so that the "blanks" it contains will present themselves one by one at the bottom. A mechanical hand reaches over, and, taking one of these blanks, gives it to the first part of the mechanism, which grasps the blank and bores several holes. Then another mechanical hand takes the blank and presents it to the second section, which does its "stint" in the process of plate-making. A third hand next takes the blank and presents it to the third section of the machine, which contributes its share in the conversion. These three operations finish one side of the plate.

Thereupon comes a fourth hand and passes the plate to a fourth part of the mechanism; but in doing so it turns the plate over and presents the unfinished part to the drills. A fifth hand, a sixth, and a seventh pass the plate on to the several remaining sections of the machine, and a final presents it, completed, to the reservoir beyond.

One hundred and forty-one operations on one little disk of metal, all without the aid of a human hand and each performed with an accuracy of a fraction of an inch that reaches to the fourth decimal place!

A CITY FAMOUS FOR ITS JEWELRY

One who wanders around the Bay State looking for startling applications of machinery to the making of articles useful and ornamental will find things that amaze in almost every town.

Think of ten thousand different kinds of watch-chain links produced in a single establishment! Or of a machine that converts gold wire into watch chain by the hour without let or hindrance from any man! Such machines are busy throughout the year in Attleboro.

Rolled jewelry is finding a tremendous sale all over the world, and the Attleboro factories are months behind in filling their orders.

In one plant the first step in making a filled watch chain is to prepare an ingot of copper and zinc alloy about a foot long and an inch and a half in diameter. Over this is put a sleeve of, say, 14-carat gold, cast to a perfect fit. This gold-filled ingot is then put into a machine which hammers it, reducing its diameter and increasing its length. The process is repeated by other machines until finally it becomes small enough to be drawn through dies as wire, each time growing thinner and longer until it has the diameter of the wire in the chain link.

From this stage the wire may be fashioned into links and chains either by hand or by machinery. In the latter case the wire is automatically fed into the chain machine. A small knife comes out and cuts off the length required to form a link. Two little jaws close and the bit of wire becomes the shape of a capital U. Then a tiny hammer taps the open U in such a way that it becomes an O, which, with another movement, has its position switched from horizontal to upright. Then the wire is fed through the finished link and the process repeated, the chain growing longer at the rate of many feet an hour.

MASSACHUSETTS MAKES EVERYTHING, FROM SUSPENDERS TO SILVERWARE

There are many lines of manufacture in which Massachusetts is the nation's leader other than those already noted. The State makes seven-eighths of the nation's whips; more than two-fifths of its gum shoes, rubber boots, and linen goods; one-third of its leather belting, bicycles, and motorcycles; a fourth of its envelopes, fireworks, silverware, sporting and athletic goods, stationery, suspenders

Photograph by Herbert B. Turner

DRYING SAILS AFTER THE STORM: GLOUCESTER, MASS.

One gets a vivid idea of the wealth of the sea at Gloucester. Cod and mackerel, haddock, herring, and halibut; tautog and quahog; scup and sculpin; swordfish and spikefish; tinkers, cusk, and eels; blue fish and butterfish; flounder, perch, and sea trout; oysters, lobsters, and clams—one must tax his fishing lore to enumerate the species that are brought into port daily.

and garters; and in all these lines surpasses every other State.

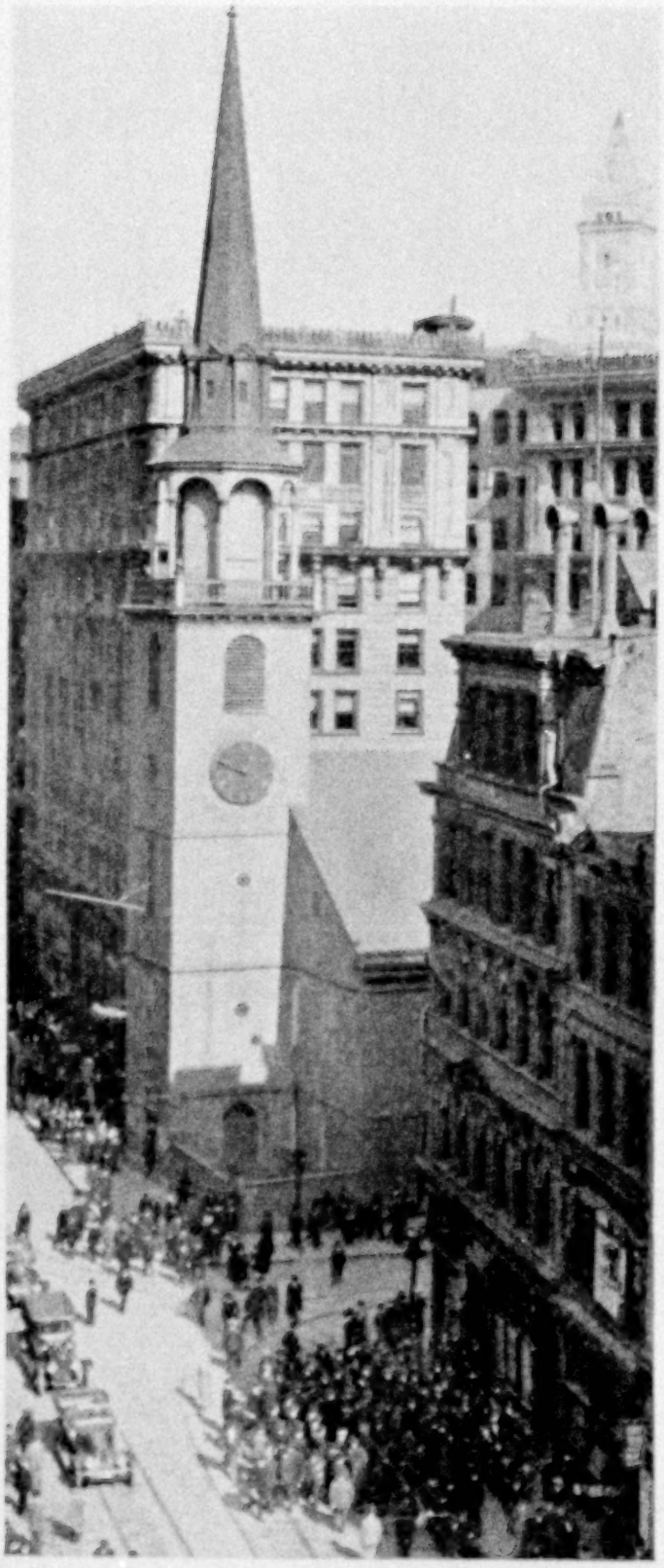
With such a vast concentration of light manufactures, it is only natural that Massachusetts should have many cities and towns; but one is hardly prepared to believe that this small Commonwealth has 32 cities of 20,000 population and upward, more than any other State of the Union. More than 100 of its smaller municipalities have populations above the 5,000 mark.

"THE HEART OF THE COMMONWEALTH"

About each of the principal cities a word must suffice. As Boston will later be described in the "Big City" series of articles appearing from time to time in THE GEOGRAPHIC, no mention of it need be made here.

The second city of the State is Worcester, which calls itself the "Heart of the Commonwealth." A busy metropolis, it has been a cradle of invention and is a center of industry. Within a radius of fifteen miles of its central square were born Eli Whitney, whose gin made cotton the fabric of civilization; Ichabod Washburn, who drew the first piano wire in America; Erastus Bigelow, the inventor of the carpet machine; Thomas Blanchard, who designed a machine for making tacks and a lathe for turning irregular shapes; George Crompton, the inventor of the power loom for weaving fancy cottons; and Asa Hapgood, inventor of the upper berth in sleeping cars.

Worcester has drawn enough wire to girdle the globe a thousand times. It has made enough corsets to fit out every feminine form on the earth. It has facilities for producing enough envelopes to carry



Photograph by Leon H. Abdalian

IN THE SHADOW OF THE OLD SOUTH CHURCH, BOSTON

Erected in 1729, Old South Church has lived through the vicissitudes of war and peace for nearly two centuries. Diagonally across the street from it, Benjamin Franklin was born. Within its walls were held many of the town meetings that crystallized the purposes of the colonists to be free. Not many years ago commerce would have razed its walls and reared on its site an office building. But the people of Boston raised $400,000 to keep it as a shrine of our national beginnings.

the correspondence of the world. It has the largest belt factory, the largest loom works, the largest grindstone plant, and the largest automobile crank-shaft forging plant in existence.

AMERICA'S FOREMOST MILL TOWN

Fall River, third in population among the cities of Massachusetts, is America's foremost "mill town." It has 148 textile mills and employs 40,000 operatives. That it can bring coal for power from Pennsylvania and cotton from the South, paying the high freight rates, and still compete with the South in the manufacture of cotton goods is a proof of its energy and efficient organization. Every day the city weaves enough cloth a yard wide to reach from New York to Panama. It produces more goods than any State in the Union except its own.

A close competitor of Fall River is New Bedford, making fewer yards of cloth than its rival, but specializing in finer grades, which it produces at the rate of a mile a minute. New Bedford has a twentieth-century prosperity based on cotton as great as that in the seventeenth century based on the whaling industry.

AMERICA'S CAPITAL OF EDUCATION

Cambridge is so nearly part and parcel of the New England metropolis that it seems to have lost its identity in almost every way except legally. When one is reminded that this city, with its population of 113,000, is without a daily newspaper, or a good hotel, or a modern theater, one can readily see that its identity, except for purposes of taxation and local law, has been thoroughly welded into that of Boston.

But in education it can almost claim to be the nation's capital. With Harvard and Radcliffe and Technology, its influence reaches wherever religion, philosophy, science, and engineering extend.

But Cambridge is more than a university town. It is one of the principal manufacturing centers of the Commonwealth.

"THE WORKSHOP OF THE WORLD"

Lowell proudly calls itself the "workshop of the world." It is a busy town,

possessing the world's largest hosiery and underwear mills, as well as its most extensive sail-cloth factory, upper shoe-leather tannery, cash-carrier and pneumatic-tube factories. It also has what is considered the highest type of textile school to be found anywhere.

SPRINGFIELD, LYNN, AND LAWRENCE, A THRIVING TRIO

Admirably situated in the Connecticut Valley, at the cross-roads of east and west and north and south trade, Springfield is a thriving municipality, its industries alive to the possibilities of the future, and its civic spirit a contagion that infects resident and visitor alike. The city claims that its municipal buildings constitute the finest civic group in the United States. In one of these buildings is an auditorium with a seating capacity of 4,500.

Lynn and Lawrence are such close rivals in point of population that it will require this year's census to decide their relative rank. Lynn is the woman's shoe capital of the world, and Lawrence is a great mill town, with textiles and paper its principal products. It is at Lawrence that the paper for THE GEOGRAPHIC MAGAZINE is manufactured (see pictures, pages 234-241).

CITIES FAMOUS FOR MEN'S SHOES, GUM SHOES, AND SLIPPERS

Following in order of population are Somerville, part and parcel of the Boston community, but still as independent of the Hub, governmentally speaking, as if it were at the other end of the State; Brockton, where men's shoes are produced by the millions of pairs; Holyoke, where the Connecticut River surrenders its power at Hadley Falls for paper mills, silk factories, and similar industries operated by water power at only a fifth the cost of steam power; Malden, the "gum-shoe" city; Salem, once the witch city, but now a staid and solid commercial community; Haverhill, the "slipper city"; Chelsea, industrial borough of Boston; and Newton.

Fitchburg brings up the rear of the line of cities with 40,000 population and upward. It reminds the world that it makes three revolvers a minute, five pairs of shoes, four cans of axle grease, three shirts, eight miles of yarn, ten paper boxes, fifty paper bags, fifteen pounds of brass, and other things in proportion.

One passes by with regret a hundred other splendid cities and towns, for in their history, their achievements, and their beauty each of them challenges attention.

Likewise Plymouth Rock and Provincetown, Lexington and Concord, and a score of such places are shrines that live in the hearts of all Americans.

MASSACHUSETTS' PARKS AND FOREST RESERVATIONS

In the establishment of public parks Massachusetts has displayed the same appreciation of esthetic and humanitarian values that has characterized her in other fields. Greylock, the State's highest peak, has been set aside for the public, a reservation of 9,000 acres around its summit having been created.

Mount Tom, which rises like a sentinel lookout guarding the cities of Northampton, Holyoke, and Springfield, is another place under State jurisdiction where one may go and commune with nature.

A number of State forests have also been established. One in Plymouth County, covering 7,000 acres, is appropriately named the Miles Standish State Forest. Another, in the vicinity of Andover, contains 1,200 acres, while a third, in the vicinity of Winchendon, contains 1,700 acres. There are two in the Berkshire Hills aggregating 2,200 acres. The most modern forestry methods are practiced in these areas, and the State is striving energetically to remedy the loss of her timber at the hands of an unrestrained commercialism in bygone decades.

In her verdict of November 4, 1919, Massachusetts earned the gratitude of the country and showed that the spirit that founded the greatest republic and won a world to liberty still survives and stands committed to law and order. No praise is too high for this new declaration against class tyranny, this new stand for the ideals that have always made Massachusetts great.

TÊK PAI IS THE NAME GIVEN THIS BAMBOO RAFT IN FORMOSA

The craft is characteristically Formosan. Although there is a type of bamboo raft found along the China coast, it is not nearly so large as that of Formosa, since the bamboos on the mainland cannot compare in size with those growing on this island. There is a round wooden tub in the center for luggage, and when the sea is rough the passengers sit in it, too.

FORMOSA THE BEAUTIFUL

By Alice Ballantine Kirjassoff

Illustrated with photographs by the official photographer of the Government of Taiwan and from the Chief of the Camphor Department

"ILHA FORMOSA," beautiful isle, early Portuguese voyagers called the island now owned by Japan and known to them as Taiwan. The Portuguese name has clung to it in all European countries, and never was a more appropriate name given to an isle of the sea.

If you care to confirm this in one of several pleasant ways, sail along the west coast of Formosa in a têk pai (or bamboo raft, see page 246) on a clear day, and you will witness a pageant of mountain scenery that will haunt the memory for many a day.

Beyond the fertile plain, with its emerald paddy-fields and its picturesque little villages dotted here and there on the banks of meandering streams, foothills with unending variations of contour silhouette their tree-fringed summits against the paler screen of more distant mountains. Of these, sometimes five and sometimes even six parallel ranges are visible at once, each a separate ribbon of color, shading from the deepest sapphire to the palest azure and extending in an unbroken chain of beauty from north to south.

On the east of the island you can see the highest coastal cliffs known, at some places rising abruptly to an elevation of about 6,000 feet, and affording an impregnable wall of defense to the wild aboriginal tribes living in the mountains back of them.

AN ISLAND OF AMAZING VARIETY OF VEGETATION

Formosan scenery is unusual in its diversity of vegetation within such narrow confines—the greatest length of the island from north to south is about 264 miles and 80 miles is its greatest width.

From the palms and tropical fruit-trees of the western plain it is only a short step to the slopes of the lower mountains, with their exuberant jungles of various growths—the bearded banyans, the graceful tree-ferns, which in sheltered nooks attain the height of palms, and the ubiquitous bamboo grass.

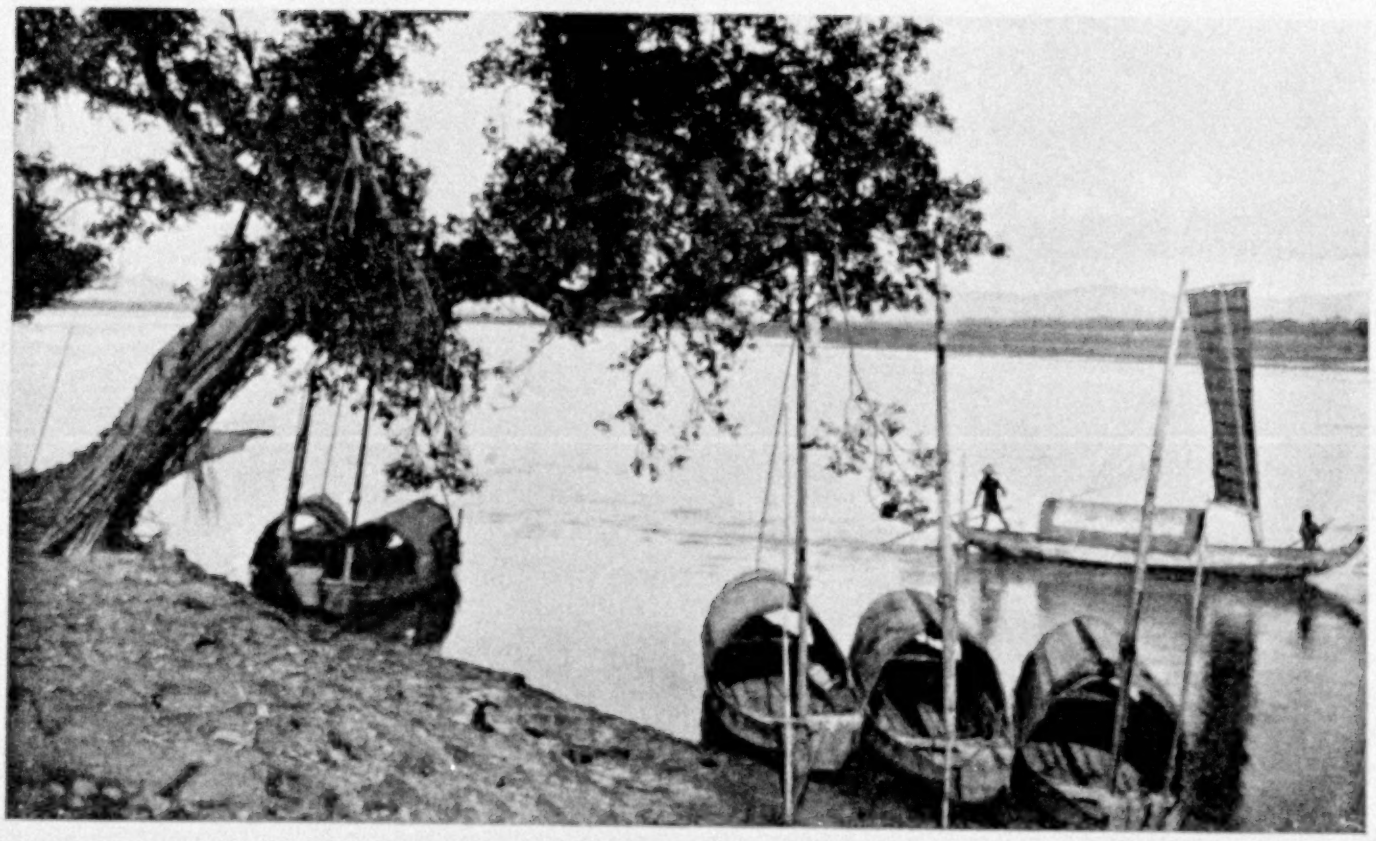
Here, among moss-strung trees, is found growing the beautiful butterfly orchid, while in exposed spaces, nestling among the rocks, rose-pink azaleas flaunt their gay blooms. A little higher are plateaus covered with camphor laurel, the largest tracts of these valuable trees in the world, while still higher grow the forests of coniferous trees — the giant benihi, similar to the redwoods of California, the largest trees in the East and the second largest in the world; the valuable hinoki, or Japanese cypress, and the pine, cedar, and spruce of the New England States; and higher yet the craggy peaks of the tallest mountains, but sparsely covered with vegetation of any sort, where eagles build their nests, and which for the greater part of the year lie beneath a mantle of snow.

"THE SECOND WETTEST PORT IN THE WORLD"

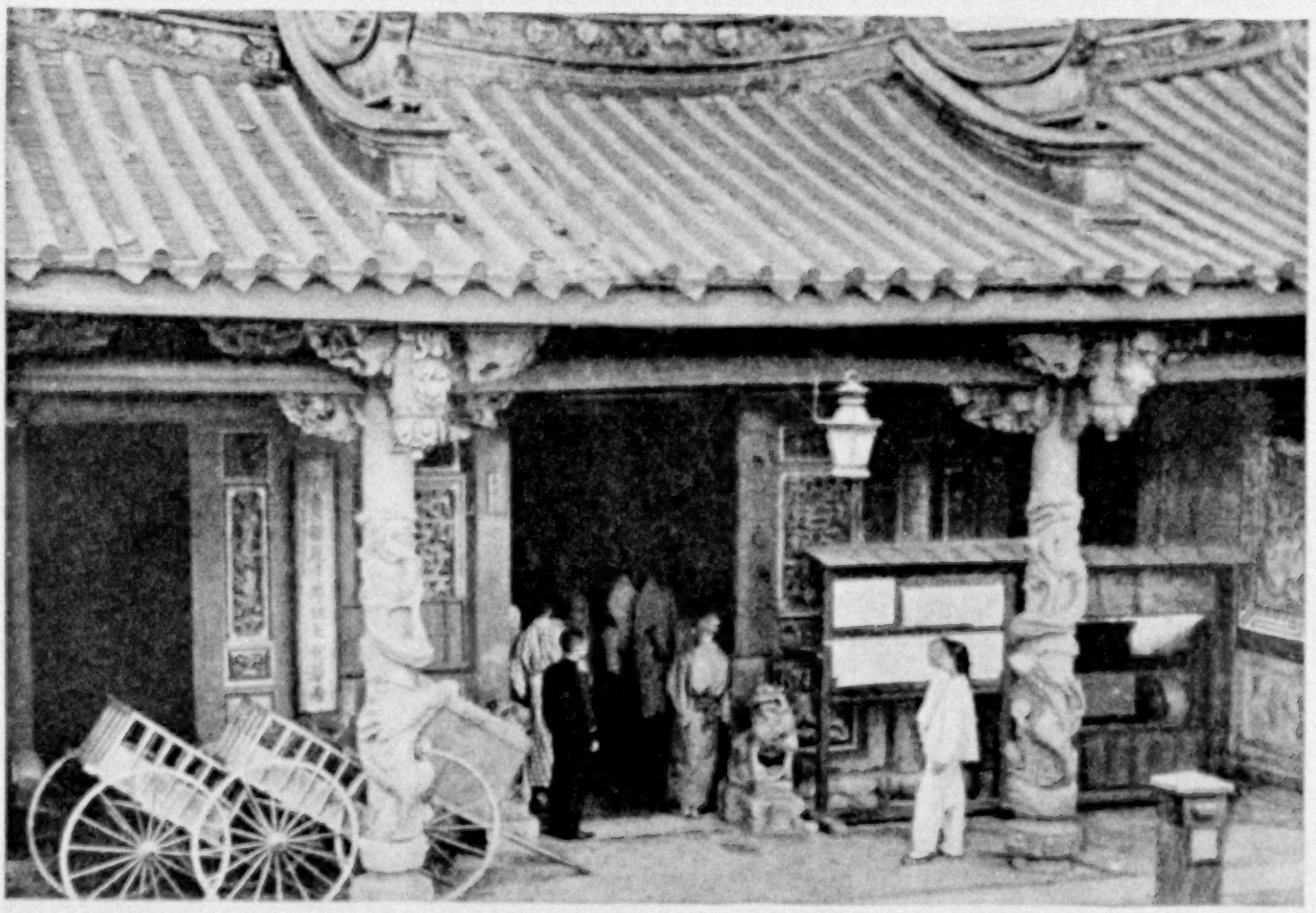
The usual approach to the island is the port of Kelung, in the extreme north. It was here that the author of this paper landed after a four days' steamer journey from Kobe. The rain was coming down in sheets, obscuring the hill-crested harbor, and all looked gloomy except for one bright patch of sky, where the sun was struggling to come through.

I remember reading in my old grammar-school geography that Kelung is the second wettest port in the world, and I have no trouble in believing it. I have been there many times, and each time it has rained. Without showers, Kelung would wear an unrecognizable face, like a person without spectacles who was accustomed to wearing them.

After disposing of the numerous porters who escorted me from the steamer,

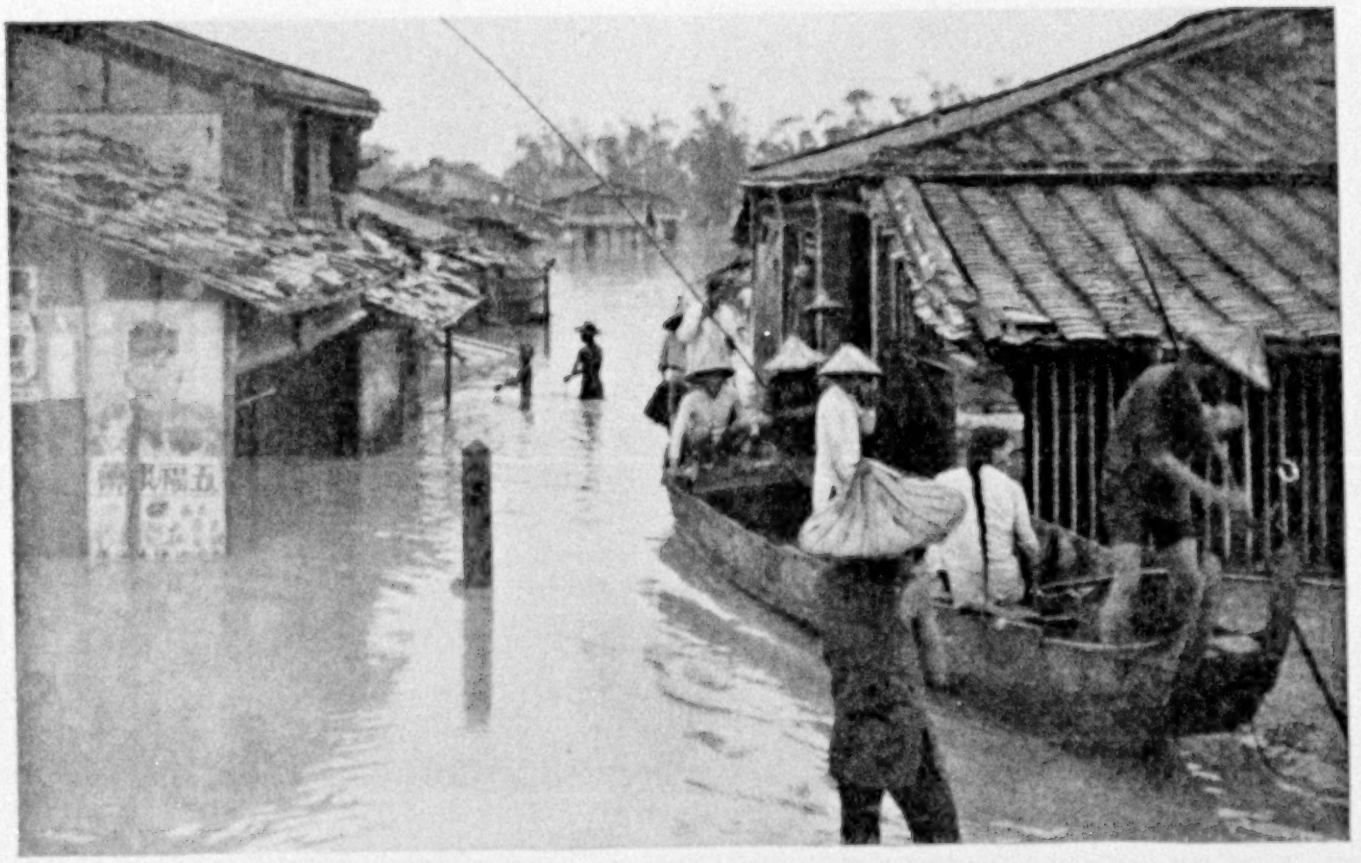


SAMPANS NEARING THE BUND: TAIHOKU, FORMOSA

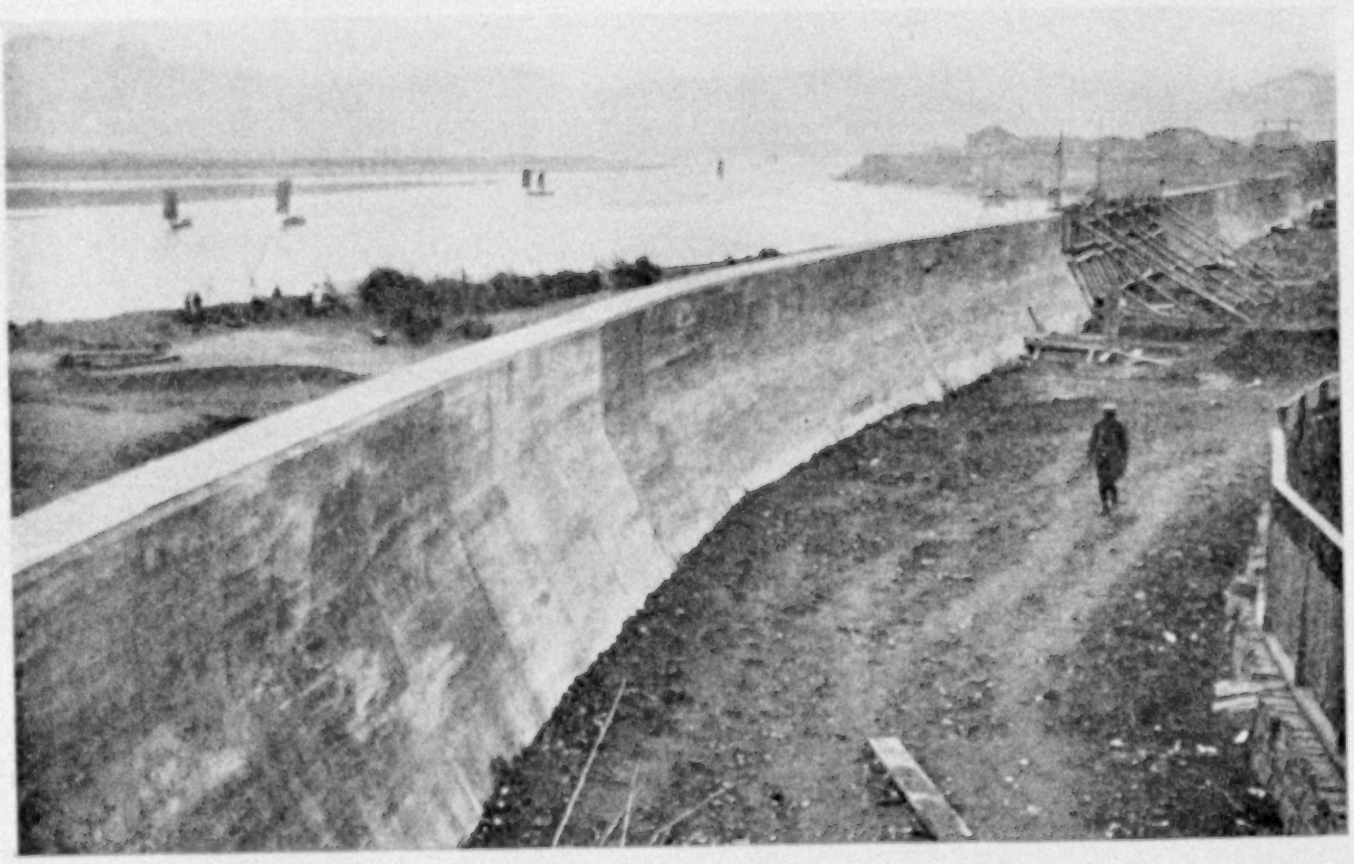


DAITOTEI IS UNNATURALLY CLEAN FOR A CHINESE CITY

Formerly Manka, Daitotei, and Taihoku proper (within the castle walls) were three independent cities, but with the establishment of the Governor General's Office in the castle and the principal administration offices around it, the three sections became amalgamated into Taihoku. Daitotei is the Chinese section of Formosa's busy capital.

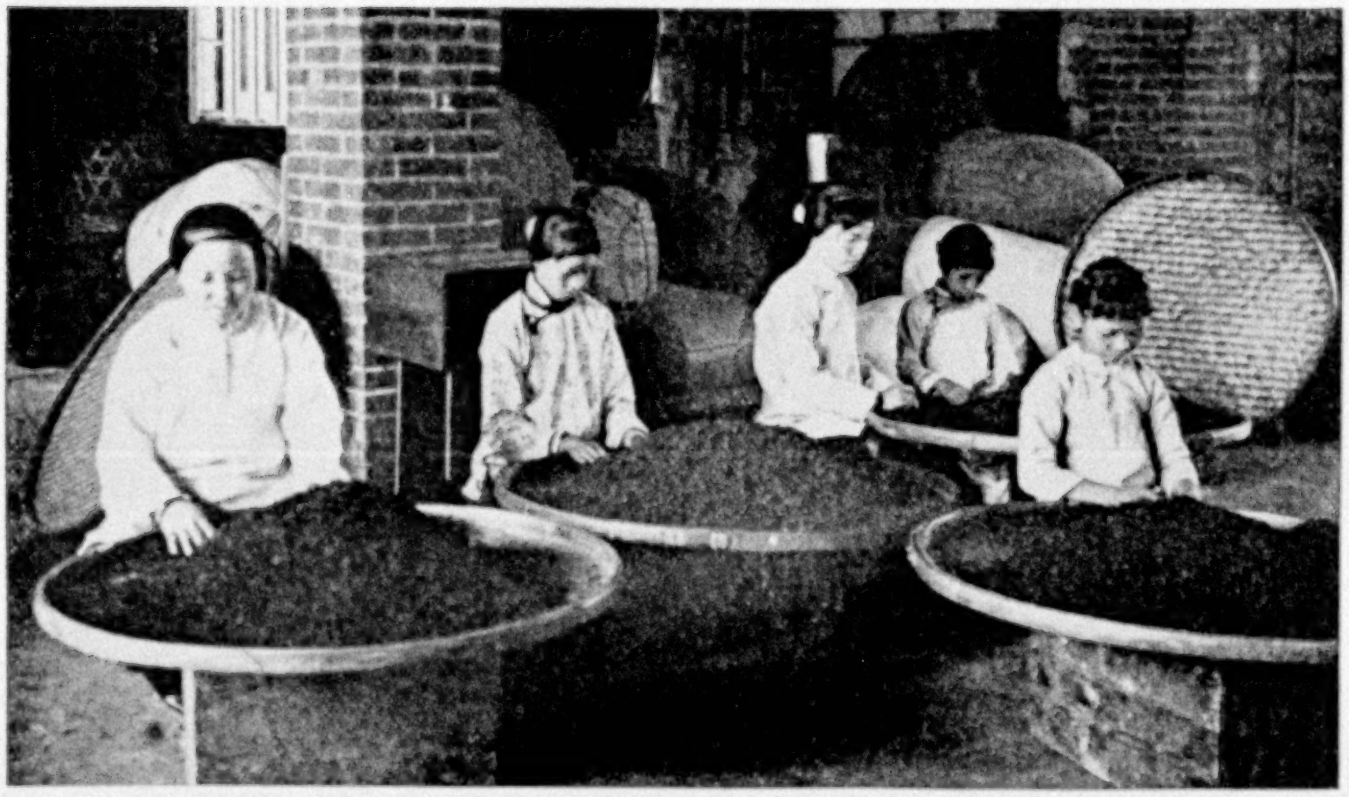


THIS IS NOT CHINATOWN IN VENICE; ONLY A STREET SCENE IN THE CHINESE QUARTER OF TAIHOKU AFTER A TYPHOON



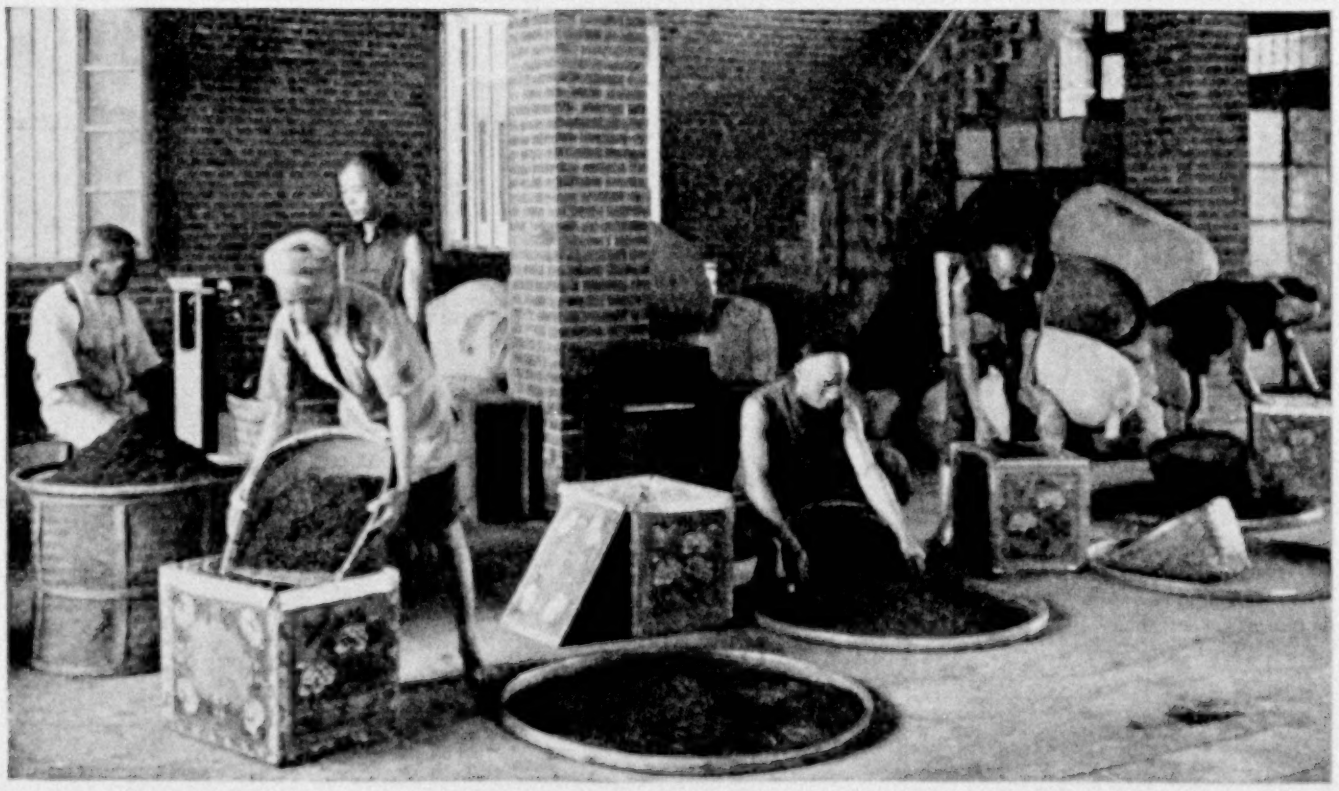
VIEW OF THE DAITOTEI BUND SHOWING THE TYPHOON WALL; TAKEN FROM THE EXTREME SOUTHERN END OF TAIHOKU

Formosa is frequently swept by violent storms, the sea immediately to the south of the island being known as the "birthplace" of typhoons. In an easterly storm which visited Taihoku 22 years ago the wind attained a velocity of 97 miles an hour.



TEA-PICKING GIRLS IN DAITOTEI: FORMOSA

"Seated on low stools before wide wicker trays, these bright-eyed maids in their peacock-blue smocks, their front hair clipped in bangs, and with a gay posy or two stuck in the braided knots at the backs of their necks, were in animated contrast to their rather drab surroundings."



COOLIES PACKING OOLONG TEA

Nine-tenths of Formosa's Oolong tea finds its way to the United States. It is shipped in lead-lined boxes to protect the sensitive leaves from the salt air of the sea voyage and from contamination with the odors of other freight. Even this precaution cannot safeguard Oolong from some cargoes—copra, for example. If an Asiatic disease makes its appearance on board and the vessel is subjected to fumigation, the cargo of the tea ship is practically ruined.

A DUCK-TENDER GIVING HIS BROODS A SWIM

Formosans are extremely fond of ducks. On a walk through country districts the traveler frequently encounters a youth with a long pole acting as tender for two or three hundred, sometimes a thousand, birds which have no special feeding ground, but wander over the countryside, eating and drinking wherever they choose.

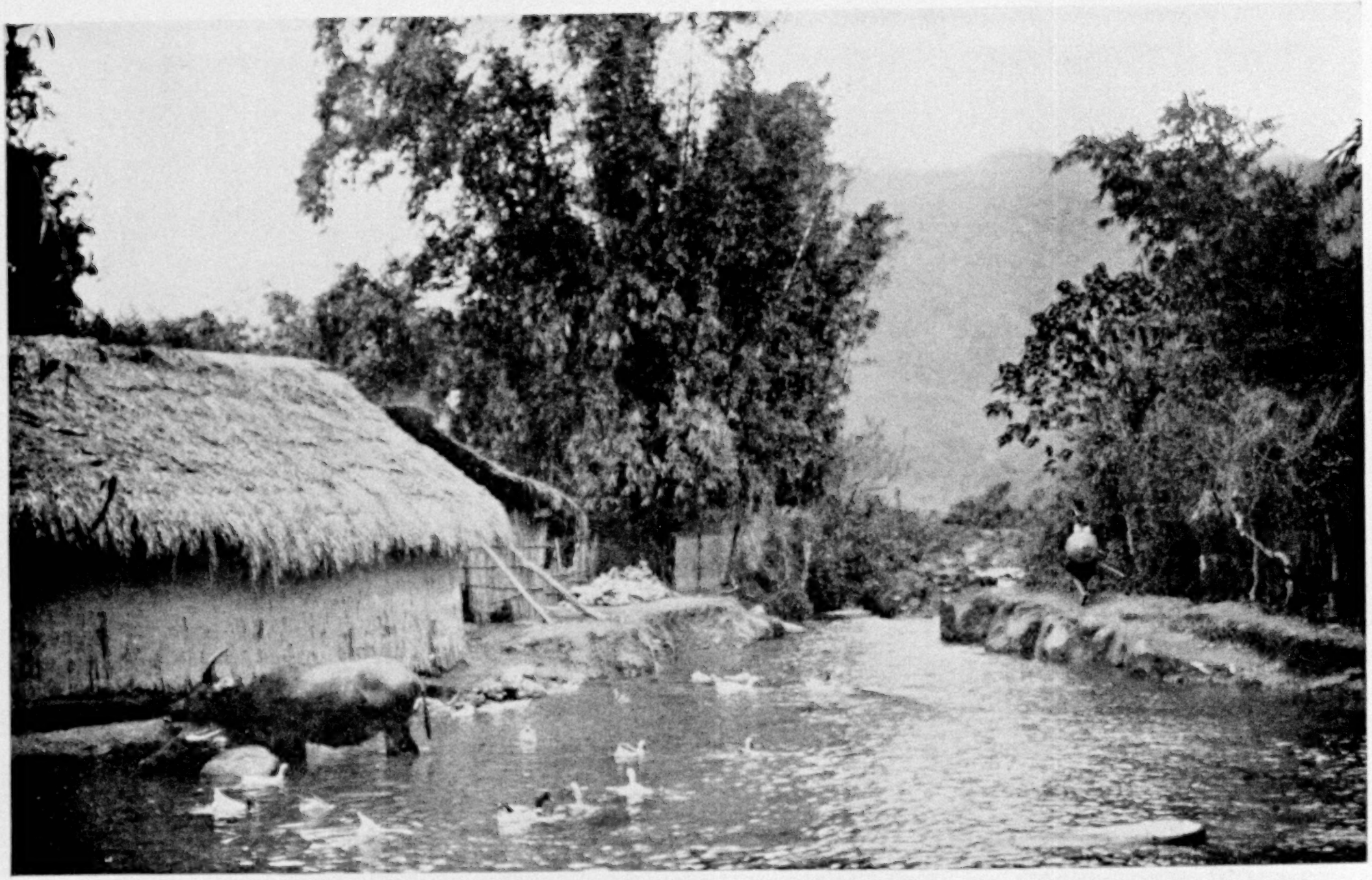
SCENE IN FORMOSA'S OPIUM MONOPOLY BUREAU: THE ROUND BALLS OF CRUDE OPIUM ARE IMPORTED FROM INDIA AND THE FLAT PARCELS COME FROM PERSIA

Opium smoking is controlled by license. About 2 per cent of the Chinese in Formosa are still addicted to the habit, but year by year the practice is being checked. The island has a population of more than 3,600,000, more than 92 per cent of whom are classified as "Formosans," mainly people of Chinese blood; a little more than 3 per cent are Japanese, and 3½ per cent are aborigines ("ripe" and "raw" savages; see text, page 272).

AN ORCHESTRA OF CHINESE "SING-SONG" GIRLS

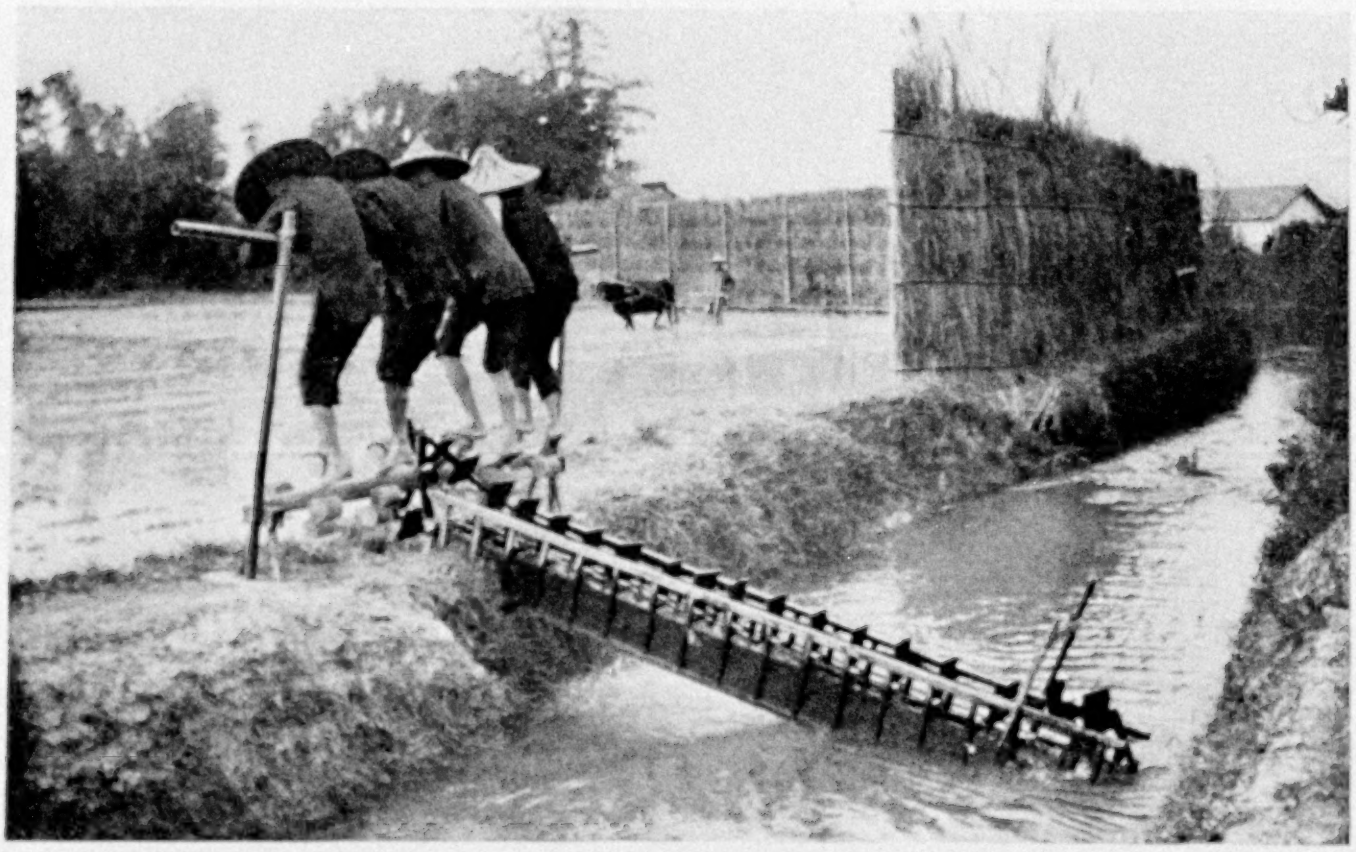
This is the Formosan version of the "jazz band." The youthful musicians provide the entertainment for tea-house habitués.

XUM



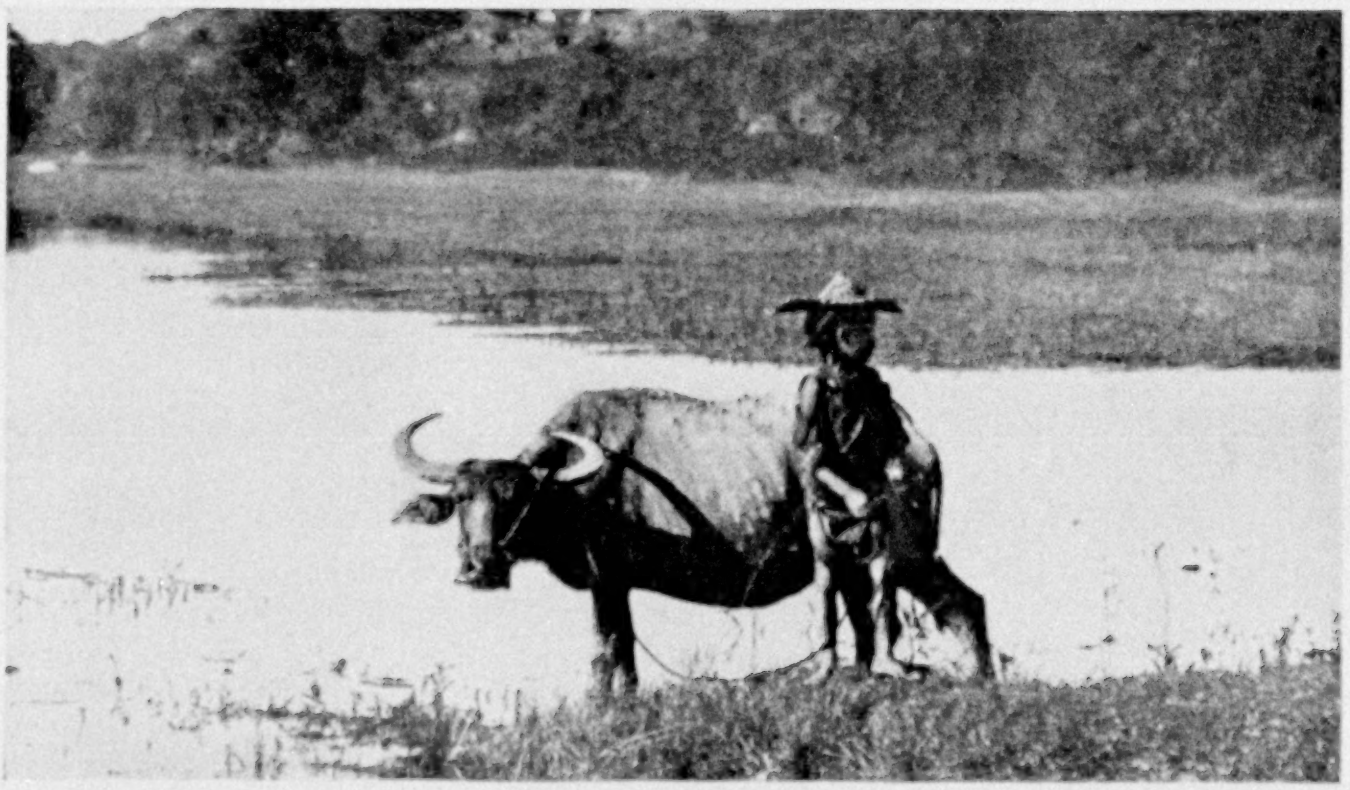
A TYPICAL CHINESE HOMESTEAD IN FORMOSA—EXCEPT FOR A SOW WITH A LITTER OF PIGS!

"Here and there we passed the low, mud, thatched dwelling of some Chinese homesteader, with a pool of water by way of front yard, where huge slate-colored buffaloes were taking their noonday siesta, a goodly number of ducks and geese keeping patrol as they slept."



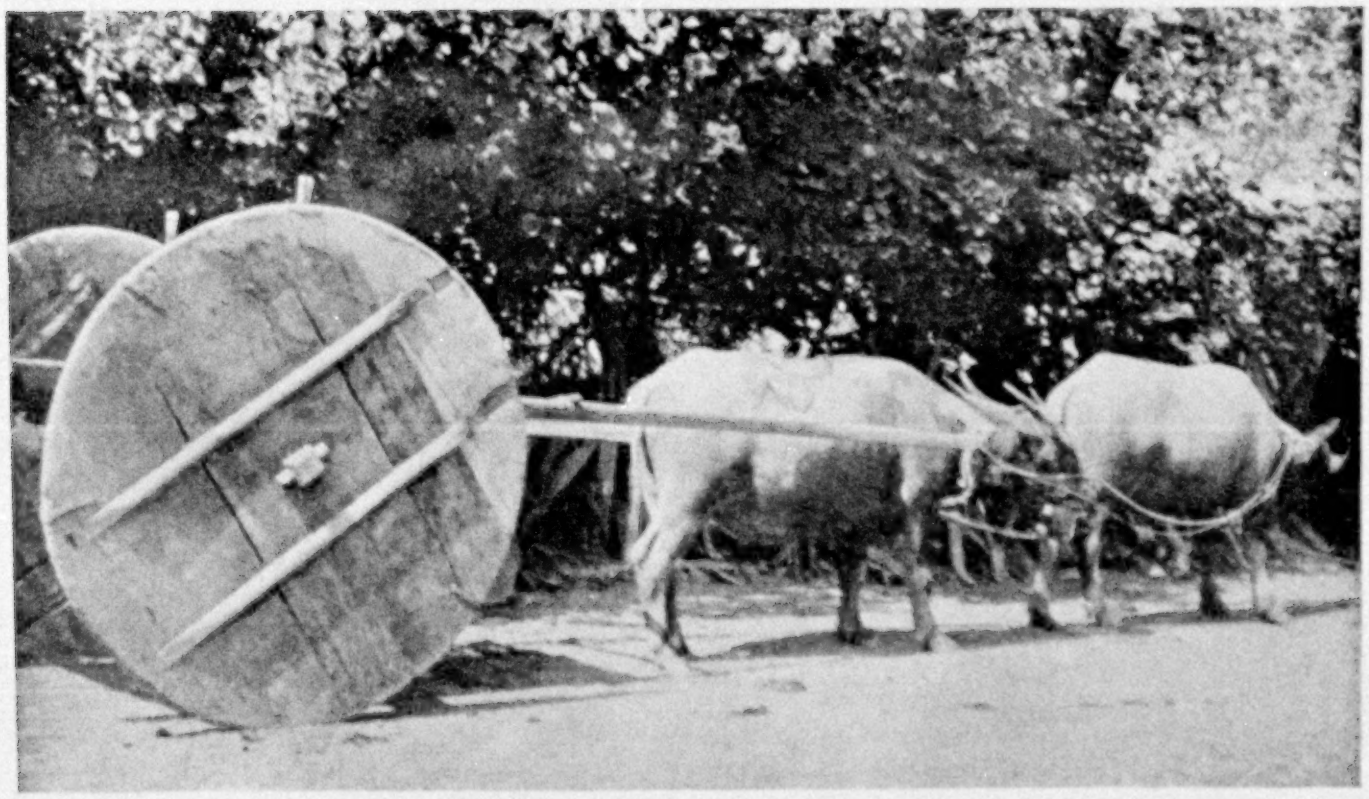
COOLIES WORKING A FOOT-PUMP AND A BUFFALO PLOWING IN THE BACKGROUND: FORMOSA

Very picturesque are these foot-pumps, worked by three and sometimes four coolies, which raise water from one field to another.



A WATER BUFFALO WITH HIS SMALL CHINESE DRIVER

No rural Formosan landscape is complete without at least one of these hulking creatures, with its threatening horns and great staring eyes. Most of the plowing on the island is done with these animals. They are strong and can endure much hard work, provided they have plenty of water, which must be poured over their backs as well as given them to drink. They may be seen on the outskirts of any large town, standing in tanks six or seven feet square while their drivers administer "shower baths."



THE TYPE OF CART USED IN THE SUGAR-CANE DISTRICTS OF FORMOSA

As the axles of the wheels are never greased, the approach of these sugar-cane-laden carts is heralded from afar by strident squeakings.

FIELDS OF FORMOSAN SUGAR-CANE

For the first time in its history, Formosa exported sugar to the United States in 1917. The other principal exports to America are Oolong tea and camphor. Although the island is world-famous for its camphor, the value of its sugar exports during one year of the World War was fourteen times greater than that of the camphor-tree product.

FRUIT-BEARERS RESTING ON THEIR WAY TO MARKET

Formosan pineapples are smaller than the Hawaiian varieties, but they make up in flavor what they lack in size. The smaller fruit are longans. From the green leaves of the pineapple the Formosans get a fiber which they convert into a cool summer cloth. The island is no less famous for its flowers than for its fruit.

LABORERS THRESHING RICE

The portable tubs constituting the Formosan's threshing apparatus look for all the world like sails, in the wake of which follow the threshers with their bundles of grain. These they rap smartly against the corrugated boards affixed to the tubs, to separate the rice from the blade.

I boarded a train for Taihoku, the capital city, which on most maps still bears its old Chinese name of Taipeh.

In about ten minutes we passed through a long tunnel, and when we came out on the other side of the mountain gap the landscape was flooded with sunshine. Rain seemed as out of place in this new world as stars in the broad daylight.

The lush green rice-fields, with the denser green hills and purpling mountain back of them, lay glancing in the sunlight with a brilliancy that contrasted sharply with objects but so recently viewed through the rain.

Here and there we passed the low, mud, thatched dwelling of some Chinese homesteader with a pool of water by way of front yard, where huge slate-colored buffaloes were taking their noonday siesta, a goodly number of ducks and geese keeping patrol as they slept, while on the brink would waddle a black sow or two, of an elongated variety, with backs that sagged in the middle, their numerous offspring following grunting at their heels.

A BENIHI TREE (*Chamæcitaris formosensis* MATS.)

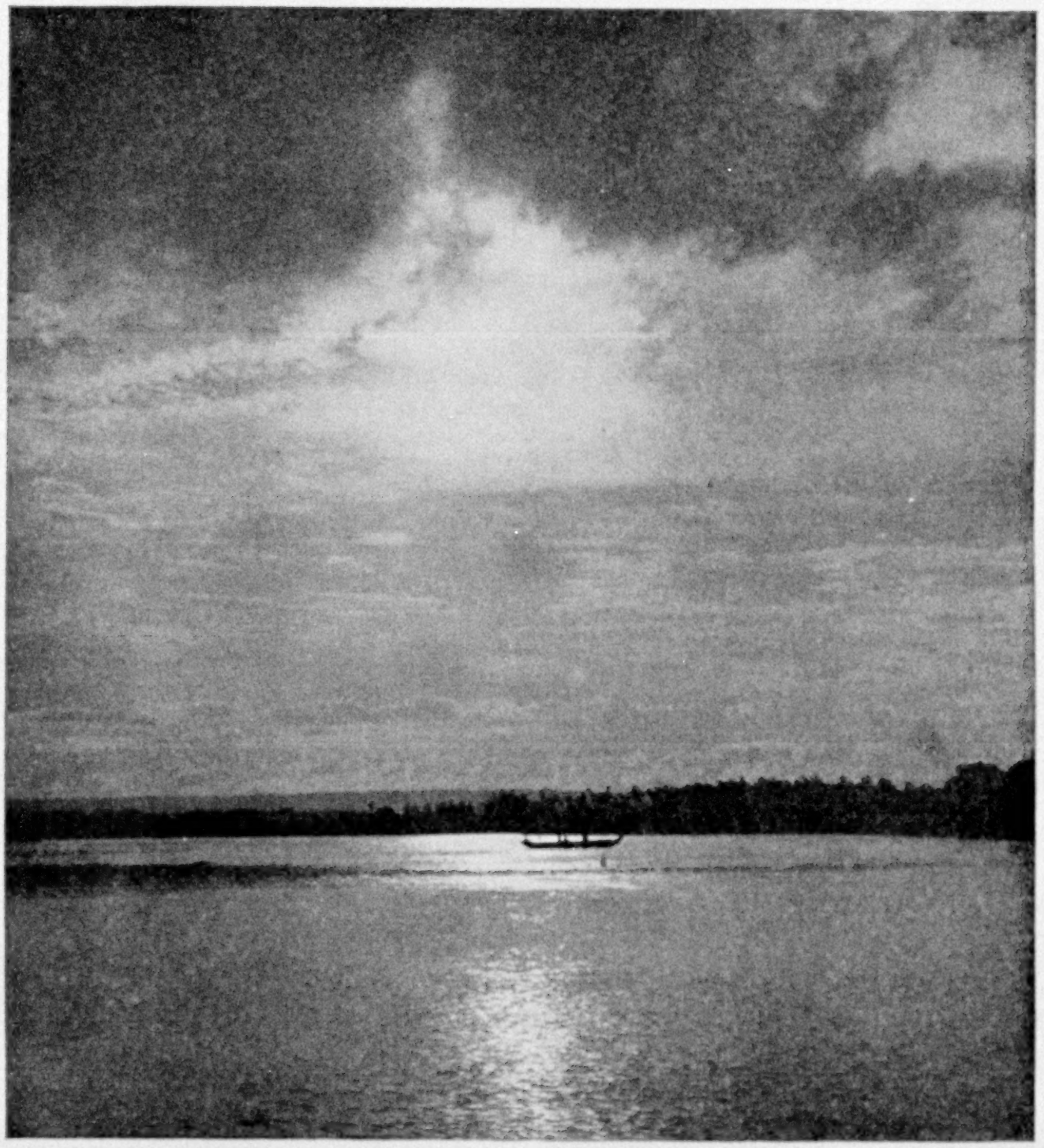
The giant benihi of Formosa, similar to the redwood of California, is the largest tree in the East and the second largest in the world.

I looked about in vain for a barn of some sort to house these creatures by night, but was told to my surprise that they were all dearly beloved members of one household and lived together most amicably under the same roof with their owner.

At length we arrived at Taihoku, covering the distance of twenty miles in a little more than an hour. I was amazed at the westernized appearance of the city—the broad streets, the beautiful parks, and the imposing public buildings.

A JAPANESE HOUSE-CLEANING TWICE A YEAR

Japanese cities, which I had so recently visited, possessed the picturesqueness of the Orient, and I had expected even more of this quality in what I had looked upon as a most out-of-the-way corner of the globe. Only the gateways of the old wall, which surrounded the ancient Chinese



SUNSET FROM THE BUND, THE WATERFRONT IN DAITOTEI, THE CHINESE SECTION OF TAIHOKU, CAPITAL OF FORMOSA

At sunset dusky ghosts of sampans, laden with families living up the river, glide homeward against a jonquil sky. Taihoku, a city the size of Lowell, Mass., is situated 20 miles southeast of the port of Tamsui, at the mouth of the Tamsui River, and 18 miles southwest of Kelung, the seaport possessing the best harbor of the island (see map, page 252).

city, remain, looking as out of place in their rejuvenated setting as the Egyptian obelisk in Central Park.

I found more of the quality I had looked for in Daitotei, the Chinese section of Taihoku; but even Daitotei was unnaturally clean for a Chinese city.

The Japanese insist upon two official house-cleanings a year, and as they are executed under a policeman's vigilant eye, you may be sure that there is nothing slipshod in the undertaking. All a man's chattels, his Lares and Penates, his wives and children (I say wives advisedly, for if a Chinaman can afford it you can count on his having more than one), even to his cherished opium pipe, all are heaped unceremoniously in front of his dwelling, and the work of scouring begins.

Everything he owns is washed, within

A JUNK ON THE TAMSUI RIVER

The antique sails, patched and repatched, speed the oarsmen when sailing down-stream with the wind.

and without, except his wives and children, and this additional sanitary measure would round out a very good beginning toward that attribute which is attested as next to godliness.

MUSIC TO SAVE THE DYING FROM EVIL SPIRITS

However, in respect to noise, Daitotei is characteristically Chinese. There is never an hour of the day without some puppet show and its accompaniment of drums and cymbals, or a marriage procession, or a funeral procession, or, at best, a few bunches of fire-crackers to celebrate the birthday of some indulged urchin, the apple of his father's eye.

If any of the sounds attendant on these rites are lacking, there can always be heard the piercing music of "sing-song" girls, entertaining tea-house habitués, the far-reaching cries of push-cart vendors, the high-pitched, unintelligible chatter of the passers-by, and, at the risk of intro-

Photograph by B. Boning

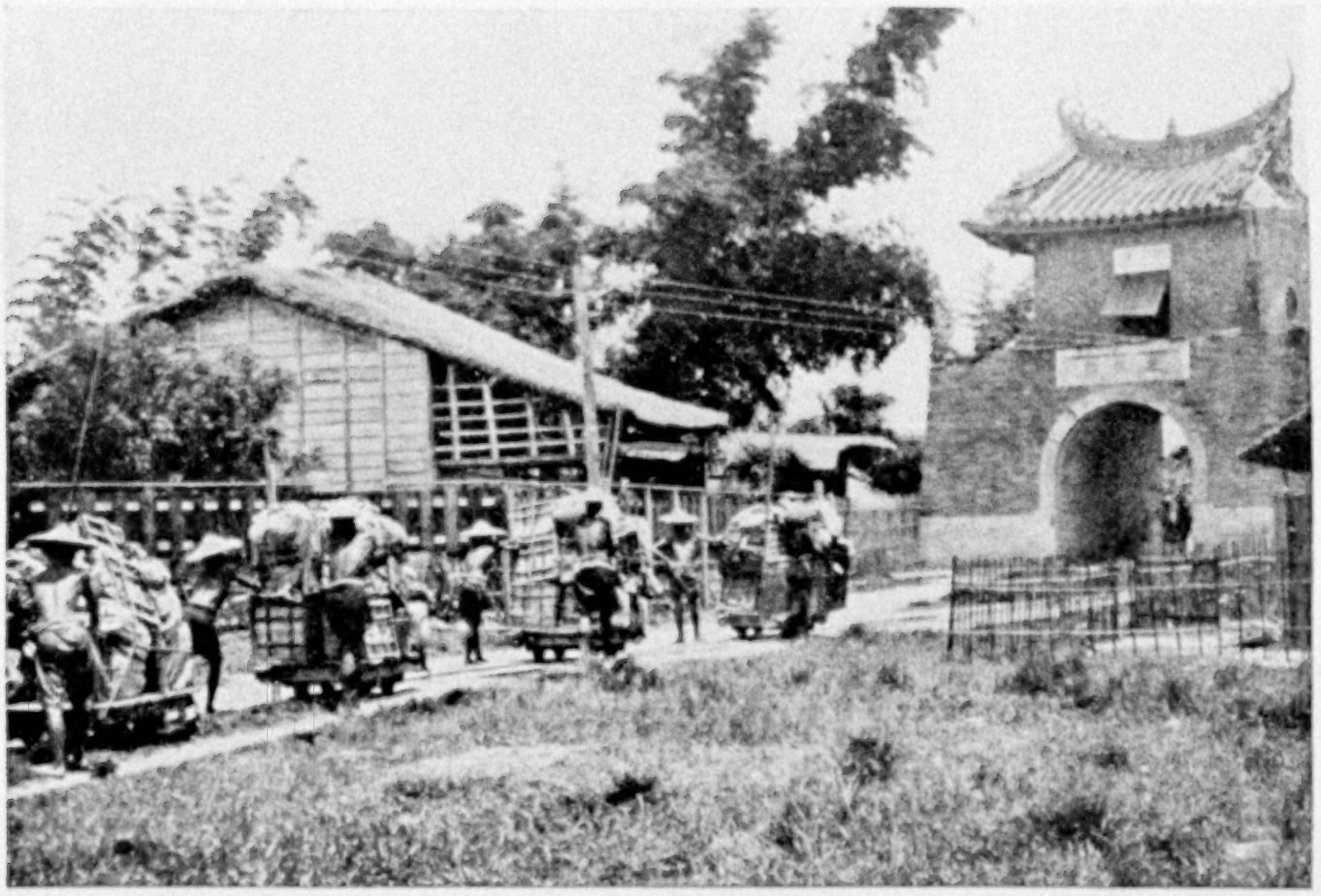
PASSENGER PUSH-CARS IN FORMOSA

ducing an anti-climax. I might add the cackle of hens; for so numerous are these denizens of the barnyard that it seems to the nervous onlooker as if some one has either just stepped on one or just avoided stepping on one.

I shall never forget my first night in Daitotei. I was tired out by an arduous day, but my determination to retire early was dealt a sudden blow by the outbreak of a Chinese orchestra in the narrow alley at the back of our house. Its irritating discordances, repeated fortissimo in rapid, monotonous succession, not only drove away all idea of sleep, but incidentally nearly drove me mad.

Our servant, upon being questioned, informed us—but not in just these words—that our next-door neighbor, a wealthy Chinese money-lender, was about to give up the ghost. After repeated objections on my part as to the advisability of accelerating his end in this violent manner, I was assured that the music was intended only to drive off such evil spirits as might be lurking about the house.

There is no doubt that the music was admirably adapted for this objective, and



PUSH-CARS BEARING IMPERIAL JAPANESE MAIL

All the baggage push-cars are third class. The passenger cars are first class and have the right of way. The third-class cars have to be derailed to allow the first-class cars to pass, although it would be far more convenient if the first-class cars were derailed, as the others are usually heavily loaded.

seeing that there was no hope of relief, I resigned myself to the rather meager consolation of playing the innocent's rôle in suffering for the guilty. However, when I was told that the Japanese have instituted a ruling whereby all music of this nature must cease at midnight, I felt a more substantial basis for thankfulness.

THE TEA-PICKING GIRLS AT WORK

During the summer months Daitotei presents its busiest face, for it is then that the tea season is in full swing. The colonnades of the tea *hongs,* if such an imposing architectural term as colonnades can be fittingly applied to such unimposing structures, are ahum with the staccato accents of chattering tea-pickers. These are generally young girls, as old hands are too numb for the deft manipulation of the tea leaves.

Seated on low stools before wide wicker trays, these bright-eyed maids, in their peacock-blue smocks, their front hair clipped in bangs, and with a gay posy or two stuck in the braided knots at the backs of their necks, are in animated contrast to their rather drab surroundings.

With flying wisps of fingers, at least one of which on each hand has a long, carefully trained nail, a rather inconvenient concession to a fashion which originally spelled leisure, they separate the coarser twigs from the partially fired tea leaves; and, just as in all probability well-bred western matrons will exchange a few words of gossip over their cups of tea, these cheerful tea-picking girls start the ball a-rolling on this side of the globe.

Not so many years ago the tea-chests were decorated by lightning artists with tropical-looking birds and beasts, but now designs are stenciled on sheets of paper, which are pasted on the boxes and glossed over with varnish.

Everywhere we saw coolies packing these gaily-flowered, lead-lined boxes that carry their sensitive freight of tea to America. I say America, for about 90 per cent of Formosa Oolong goes to the

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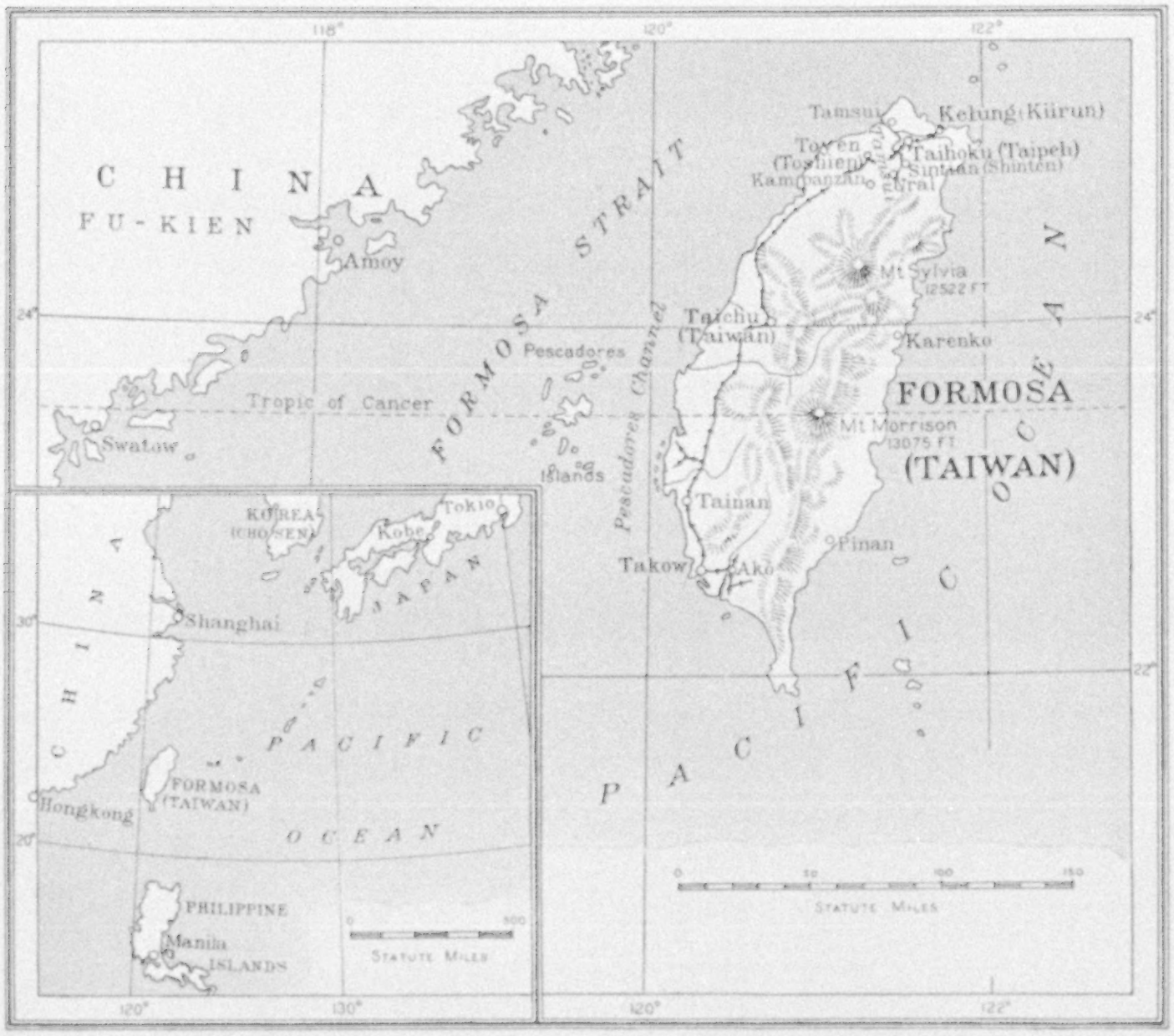


A MAP OF FORMOSA (TAIWAN) SHOWING ITS GEOGRAPHICAL RELATION TO JAPAN, CHINA, AND THE PHILIPPINES

United States. The little that goes to England is generally used in making choice blends in combination with other teas.

GUARDING TEA FROM OBNOXIOUS FREIGHT

As an additional protective measure, each chest is sewn up in reed matting. So sensitive is tea to other freight that a tea merchant, before he loads his cargo, has to find out what goods a ship is carrying in her hold. Tea and copra, for instance, cannot travel together with anything approaching congeniality. Moreover, if it so happens that some Asiatic disease breaks out on the ship and the hold is fumigated, the tea might just as well have caught the disease and died, for its commercial life is at an end.

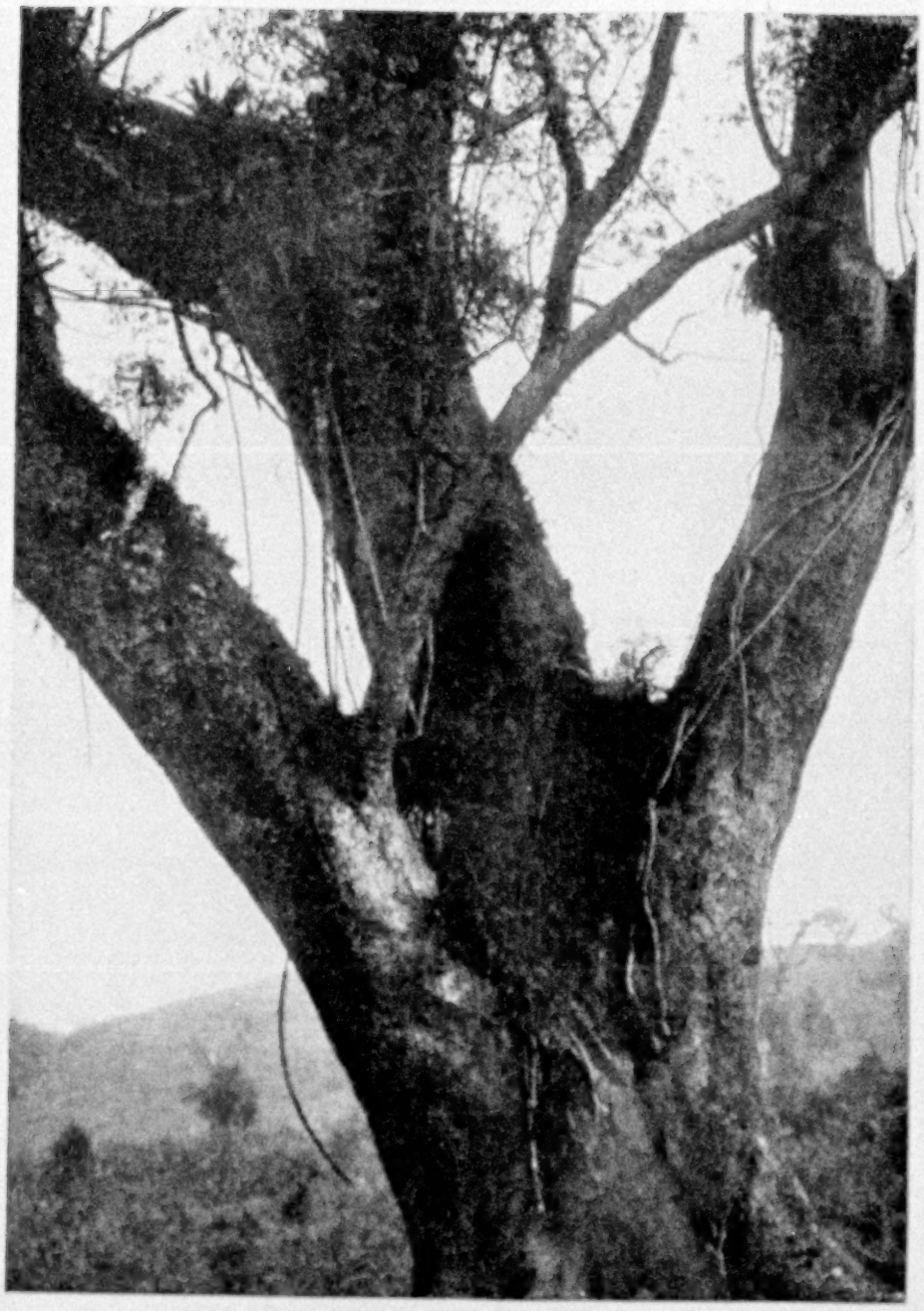
Besides the Oolong tea, whose natural fragrance is of the sort to commend itself to the most fastidious tea-bibber, there is an artificially scented tea, called Pouchong, produced in Formosa. This is exported chiefly to the Philippines and the Straits Settlements for Chinese consumption.

Four kinds of flowers are used in the process of scenting Pouchong—two varieties of jasmine, white oleanders, and gardenias. These flowers are grown in great quantities outside the city of Taihoku for this purpose, and are bartered on a certain street corner in Daitotei.

I shall always recall this street corner as the abode of Perfume—an oasis of Fragrance in a hostile desert. Coming down Hokumongai, the principal street in Daitotei, the sensitive western nose is

A NATIVE CAMPHOR STILL IN THE HEART OF A CAMPHOR FOREST

Native stills are scattered here and there throughout the camphor districts, where crude camphor is collected, packed in tins, and carried down precipitous mountain paths on coolies' backs to the nearest railway line, whence it goes to the refinery in Taihoku.



A CAMPHOR TREE

The camphor trees are unusually beautiful, with shapely trunks and wide-spreading branches profusely covered with graceful leaves of a soft green. According to an article appearing recently in a semi-official publication of Formosa, the camphor produced in the island at the present time is obtained entirely from natural-grown camphor trees, the supply of which, it is anticipated, will be exhausted within ten years. For more than a decade, however, the camphor monopoly bureau has been planting camphor trees at the rate of more than 3,000 acres a year. In 1919 its program was expanded to more than 12,000 acres, and this will be the annual acreage planted in future.

regaled by a thousand conglomerate Chinese odors—Chinese joss-sticks and Chinese fire-crackers, Chinese clothes and Chinese food, Chinese shops and Chinese houses, Chinese men and Chinese women. Then of a sudden comes this flower mart.

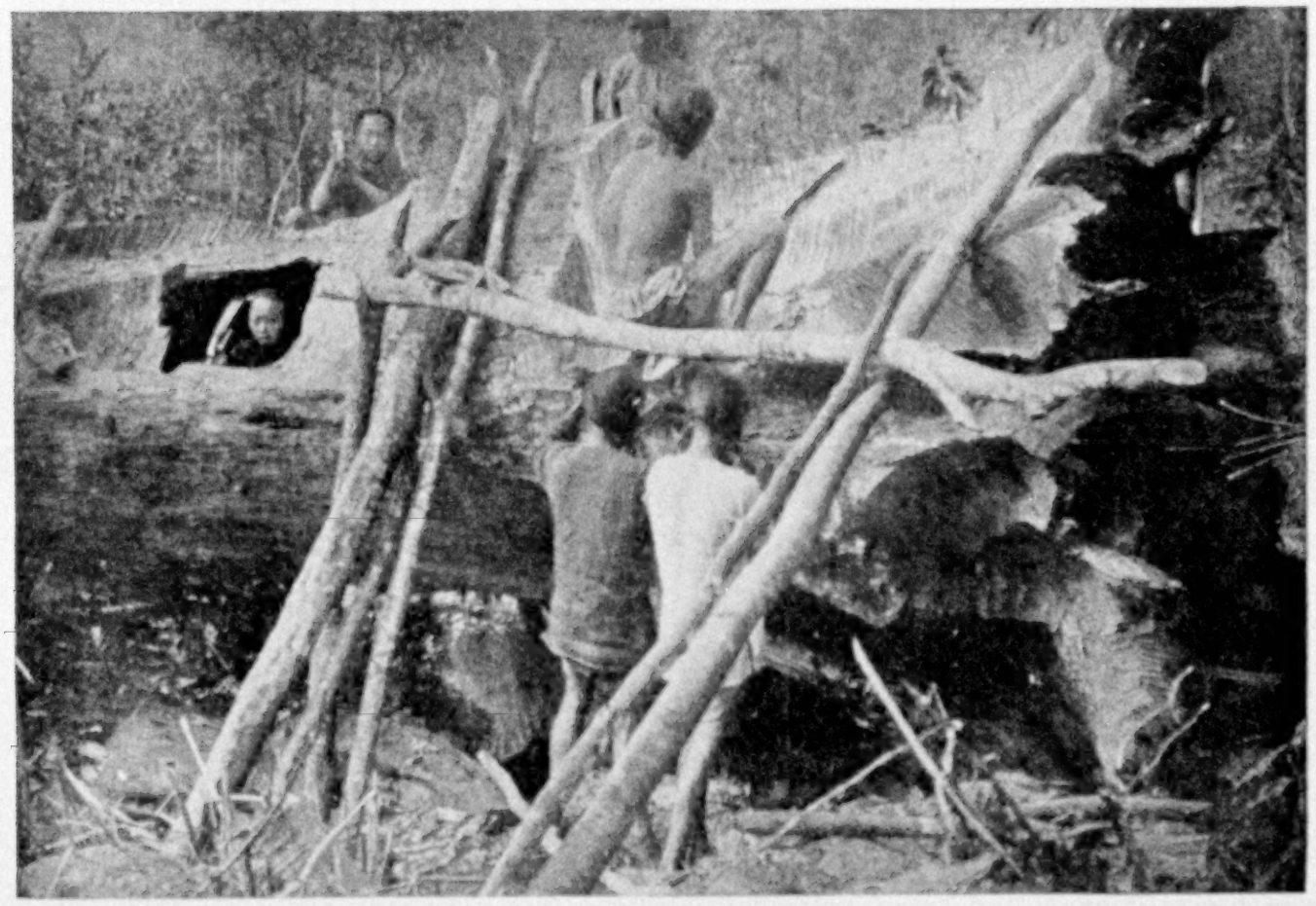
The handkerchief drops to the lap and the owner of the sensitive nose "sits up and takes notice." Are these white waxen blossoms really the gardenias we were wont to revere on account of their expensiveness? Let us try to imagine the qualms of some Fifth Avenue florist if he could but see so many potential boutonnières, at a dollar apiece, so carelessly heaped up in baskets, lining the dingy pavement.

SEARCHING FOR SMUGGLERS

However, it is to the waterfront of the Tamsui River, commonly called the Bund, that we must go if we wish to see the most picturesque part of Daitotei. Here it is that junks, with great eyes painted on the sides of the bow, bring cargoes from the ports of Tamsui and Kelung. Their antique sails, patched and repatched, speed the oarsmen when sailing downstream with the wind, but against both wind and the tide the progress of these clumsy craft is slow indeed.

The customs jetty is the scene of the most animated discussions, for the customs officials are very thorough in their search for smuggled goods, and the junk-owners, many of whom bring wares from the China coast, are just as eager to assert their innocence. More often the barter is merely in local products, such as charcoal from some hillside kiln a few miles upstream, or sweet potatoes, which with the soaring price of rice are a chief staple of diet among the poor.

A junk's crew has no regular meal hours. At almost any time, while the



A CHINESE FAMILY WORKING A CAMPHOR TREE

Few trees can rival the camphor in value. An average tree, twelve feet in circumference at its base, will yield about fifty piculs of camphor (approximately 6,660 pounds), which at the present market price is worth about $5,000.

boats weigh anchor, a small party can be seen in the stern, clustering about a charcoal brazier—a woman busy dishing out bowls of soup and macaroni, and men in palm-leaf hats, their bronzed bodies stripped to the waist, hurriedly scooping up steaming threads with the aid of long wooden chop-sticks.

Every hour of the day the river is aglow with life—women washing their clothes; the footsore washing their feet; duck-tenders giving their broods a swim; fishermen trying their luck; housewives cleaning their vegetables and strips of pork; cattle and their owners fording the stream at low tide; and, at sunset, dusky ghosts of sampans, laden with families living up the river, gliding homeward against a jonquil sky.

FORMOSA THE HOME OF CAMPHOR

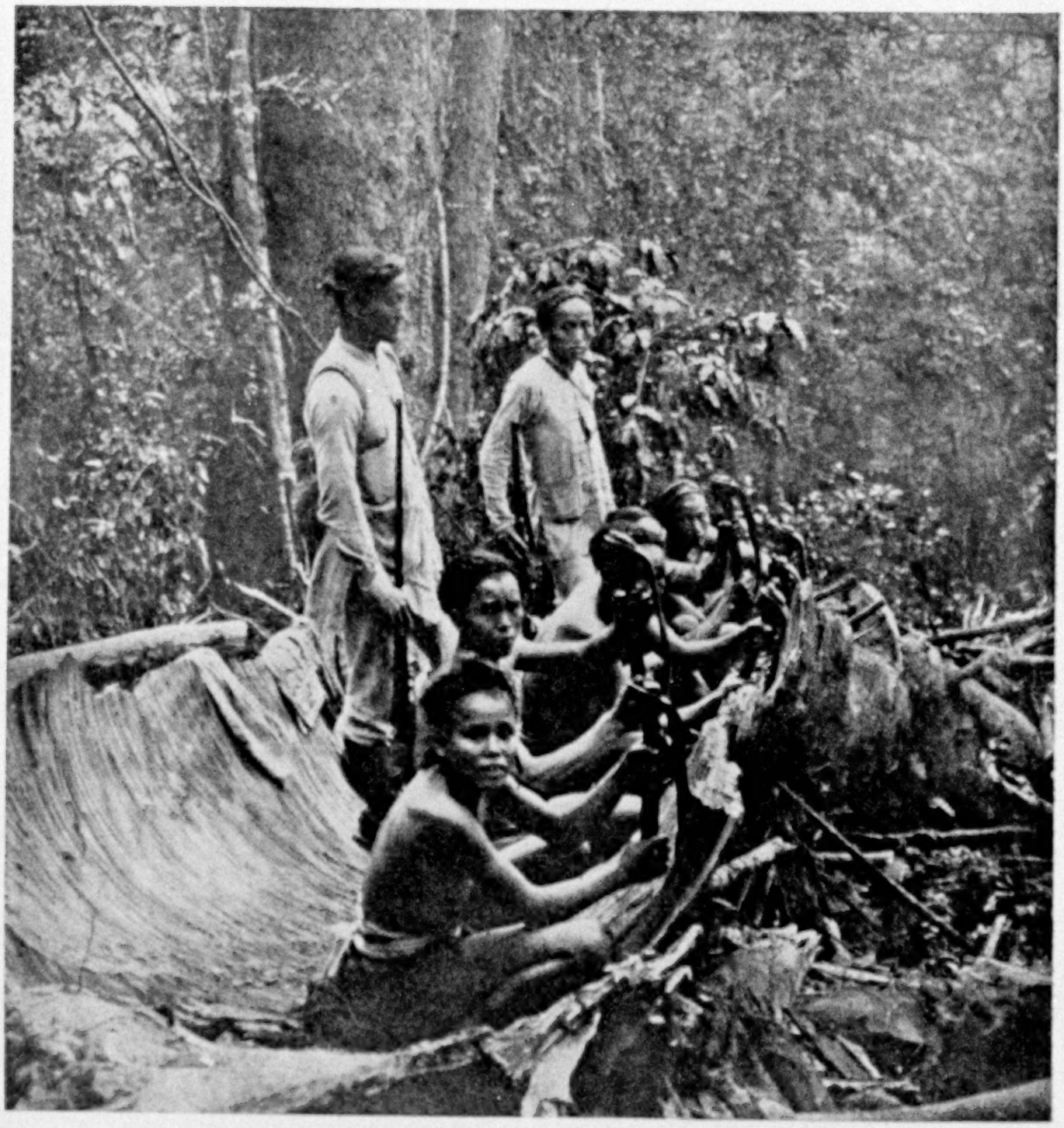
The population of Formosa is mainly agricultural. The cultivation of rice, and more especially sugar-cane, is encouraged by the government, and these are grown in great quantities.

However, the most interesting industry is the production of camphor, and it can truly be said to be peculiar to the island, when it is remembered that Formosa holds a practical monopoly in the world's market of this valuable drug.

Before the war, Germany, by a secret process, succeeded in manufacturing some synthetic camphor, but so expensive was the labor entailed that the artificial product could not compete with the natural camphor, nor is it likely to do so for some time to come.

Shortly after the Japanese came to Formosa, 25 years ago, the camphor industry became a government monopoly. Before that time there had been a great deal of ruthless waste, both in the cutting down of trees and in extracting camphor from them.

At first the Japanese, too, were careless in this respect, for the supply of camphor trees seemed practically limitless, but the great increase in the demand for the product in late years has made scientific afforestation necessary. Now



IN MANY DISTRICTS CAMPHOR WORKERS REQUIRE THE PROTECTION OF ARMED GUARDS

Tales of the camphor workers recall the days of our pioneer fathers, who constantly faced the dangers of tomahawk and scalping-knife.

large tracts of land are given over to the cultivation of the camphor laurel. The oldest of these cultivated trees are now twenty years of age, and these, I am informed, are to be cut down next year.

Paradoxical as it may seem at first glance, the savage head-hunters of Formosa have been both an impediment and a boon to the camphor industry.

As the forests are cut down, the head-hunters have to be driven further back into the mountains. These expeditions against the savages are never very successful, encountering as they do heavy obstacles in the way of dense forests, rapid streams without bridges, steep mountains without trails, and, above all, the danger of sudden attack.

The life of a camphor worker is indeed an adventurous one; he is never

GOUGING CHIPS FROM A CAMPHOR TREE

The adz is used in reducing the camphor tree to chips, which can be placed into retorts for the distillation process (see illustration on the next page).

safe. Although a woodsman with an axe never moves except in the company of an armed guard, there is always danger of an ambush.

Tales of the camphor workers recall the days of our pioneer fathers in the times of the tomahawk, the poisoned arrow, and the scalping-knife. And yet if this menace had not existed, the camphor forests would have disappeared long ago. Thanks to the head-hunters, there are still large tracts of virgin camphor forests in Formosa.

Camphor trees grow best on moderate, well-drained slopes, not over 4,000 feet in elevation, where the sun's rays can reach them.

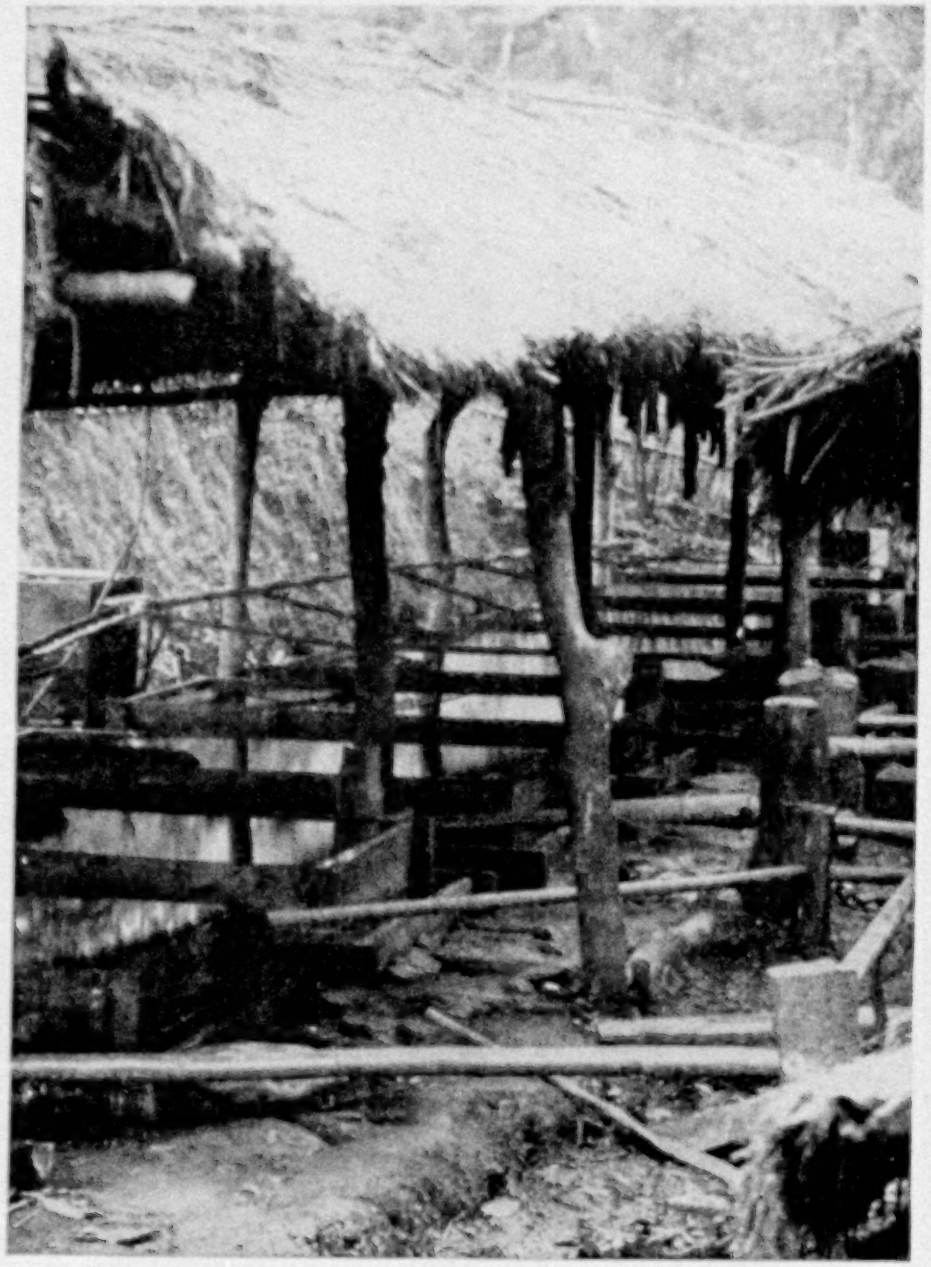
Nowhere else in the world have these trees attained such height and girth. In the past, trees with a basal circumference of from 35 to 40 feet have been noted, but these have inevitably fallen

PLACING CAMPHOR CHIPS IN THE CHIP RETORT

The retort is above boiling water. Beneath is a furnace. To the right a man is removing the chips from which the camphor has been extracted.

DRAINING OFF THE OIL FROM THE CAMPHOR: FORMOSA

Here we see the camphor placed on wooden troughs, and whatever free oil it contains drains off into tin pails.



SUBMERGED VATS USED IN CAMPHOR PRODUCTION

As the camphor vaporizes it passes through pipes into the submerged vats, which are so arranged that cool water from a mountain spring can flow over them to hasten crystallization. In the accompanying illustration the vats are shown after being lifted out of the water.

THE RAISED VATS CONTAINING CRYSTALLIZED CAMPHOR

In recent months the demand for Formosa camphor has been exceedingly heavy, especially among celluloid manufacturers. For the first three months of 1920 the Japanese Government has allotted to the United States 379,635 pounds.

victims to the woodsman's axe. Perhaps in the uncharted forests, where the savage still holds sway, more of these noble specimens still grow unscathed. At present a camphor tree with a basal circumference of 20 feet is considered a very ample specimen.

A SINGLE TREE PRODUCES $5,000 WORTH OF CAMPHOR

In point of view of value, few trees can rival the camphor. An average tree, say with a basal circumference of 12 feet, will yield about 50 piculs of camphor (approximately 6,660 pounds), which, at the present market price, is worth about $5,000.

Strictly speaking, there are no camphor forests, as the camphor laurel is only one of a number of trees growing together. The camphor trees are unusually beautiful, with shapely trunks and wide-spreading branches profusely covered with graceful leaves of a soft green.

Native stills are scattered here and there throughout the districts where crude camphor is collected, packed in tins, and carried down precipitous mountain paths on coolies' backs to the nearest railway line, whence it goes to the refinery at Taihoku.

It was my good fortune to visit one of these native stills in the district about ten miles beyond Urai, the first savage village with a police garrison to the south of Taihoku.

We motored as far as Sintian, and from there the stronger members of the party "hiked," while the rest alternately walked and rode in sedan chairs.

We had to cross many streams and we always found a Chinese ferryman with a sampan awaiting us on the bank, for our route had been kindly prearranged by the Japanese official from whom we obtained permission to enter the savage zone. There seemed to be no fixed fare, and the sampan owner accepted, as a matter of course, the few coins we tossed him on alighting.

AN ENCOUNTER WITH A "BROTHER" FORMOSAN

The ferryman at the last stream we crossed was an old "ripe" savage, with a face seared and seamy. A veritable Charon he looked, and this resemblance was heightened by a dark-colored shawl thrown over his head, for the poor fellow suffered from ague.

He regarded us with much solemnity, and I for one was trying to fathom his thoughts, when quite unexpectedly he spoke, "You and I are brothers. We are not like these," and he indicated the few Japanese and Chinese passengers at the rear of the sampan.

I was somewhat surprised, but found that all the Formosan savages have this idea. Besides themselves the world contains for them but two groups, the Chinese and the Japanese; so when they meet persons belonging to neither of these, by a process of elimination they claim them as relations.

At Urai we stopped for luncheon at a Japanese inn, and the entire savage population turned out to watch us eat. It happened that we had some caviar sandwiches in our lunch baskets, and when we had finished eating, as I had one left I gave it to an old savage chief. He ate it with great relish, and when he was through he signified his desire for more. Then I gave him a plain bread-and-butter sandwich, and his disgust was amusing to behold.

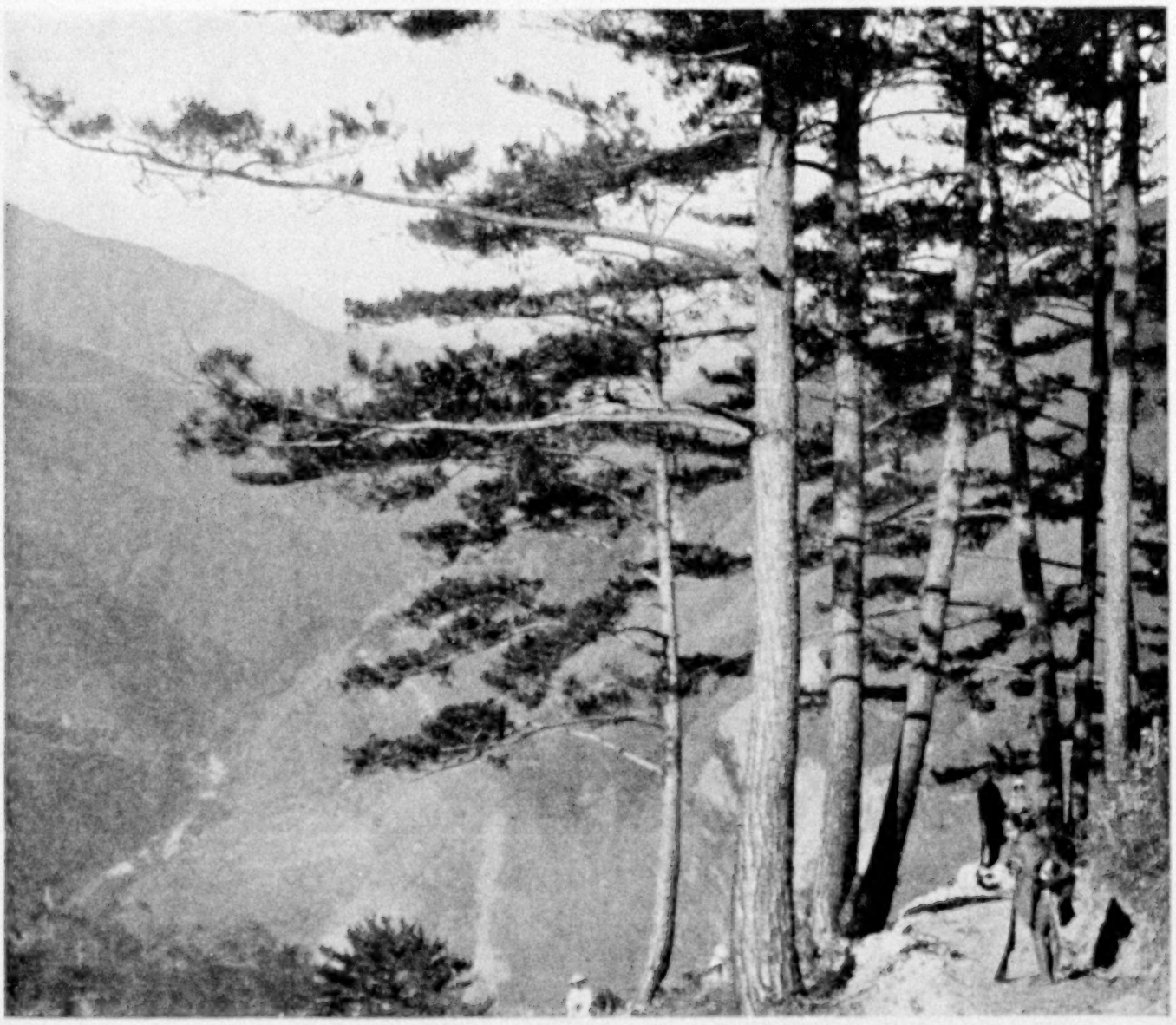
Whenever I hear of savages assimilating most eagerly the evils rather than the more substantial benefits of civilization, I think in particular of this born epicure. I am sure he would have preferred champagne to beer at first draught.

THE SIMPLICITY OF THE CAMPHOR STILL

The still we visited was operated by the members of one Chinese family. When our party approached, some of the men were gouging chips from the trunks of camphor trees with adzes, while others were in the still feeding the fires.

Adjoining the still was a shanty, where the workers lived, and in front of the door was a woman preparing the afternoon meal, while beside her a little boy was busy playing blocks with chips from which the camphor had been extracted.

The stills are operated in a very simple manner. Camphor chips are placed in a chip retort over boiling water, and as the camphor vaporizes it passes through



A PINE-CRESTED RIDGE

This photograph might have been taken in New England except for the "ripe" savages carrying guns. The border savages are often employed to assist the police guard.

pipes into submerged vats, which are so arranged that cool water from a mountain stream can run over them to accelerate crystallization. After the camphor has crystallized the vats are opened, and the product is placed on wooden troughs to allow whatever free oil there may be to drain off. This oil will yield 90 per cent of crude camphor in the process of refining.

THE PEOPLE OF FORMOSA

Ever since we have any authentic record, Formosa has been peopled with wild tribes of probably Malayan and Polynesian origin. They are nearest in point of resemblance to the Dayaks of Borneo, and although their origin has never been proved beyond a doubt, they are sufficiently like certain of the South Sea tribes to justify us in ascribing to them a common ancestry.

They are found on the island today in all stages of development. The "raw" savages, as the Chinese term them, live much as their ancestors did centuries ago, while the "ripe" savages, living on the borderland between their wild kin and Chinese settlers, have more or less assimilated Chinese ways of life.

The savage population of Formosa is estimated at about 150,000. There are eight main groups of savage tribes on the island, each group with fairly well-defined differences of dress, speech, and customs, and in many cases the tribes that make up a group display minor differences among themselves.

LUMBERING OPERATIONS IN THE HINOKI FORESTS ON MOUNT ARIZAN

Next to the camphor laurel, the hinoki, or sun trees, are the most valuable trees in Formosa. The tallest specimens attain a height of 130 feet and are of such girth as to enable a dozen people to stand on the stump of a tree that has been felled.

Although in most instances the similarities are more striking than the differences in the various groups, still they are sufficiently unlike to lead us to suppose that they migrated to Formosa at different times and perhaps from different places.

A PASSION FOR HEAD-HUNTING

There is one trait that all the "raw" savages possess in common, and that is their passion for head-hunting. With some of the groups the practice is closely bound up with their religious and social life, while with others it is more especially a question of prowess, and the brave who can display the greatest array of skulls is regarded as the greatest hero.

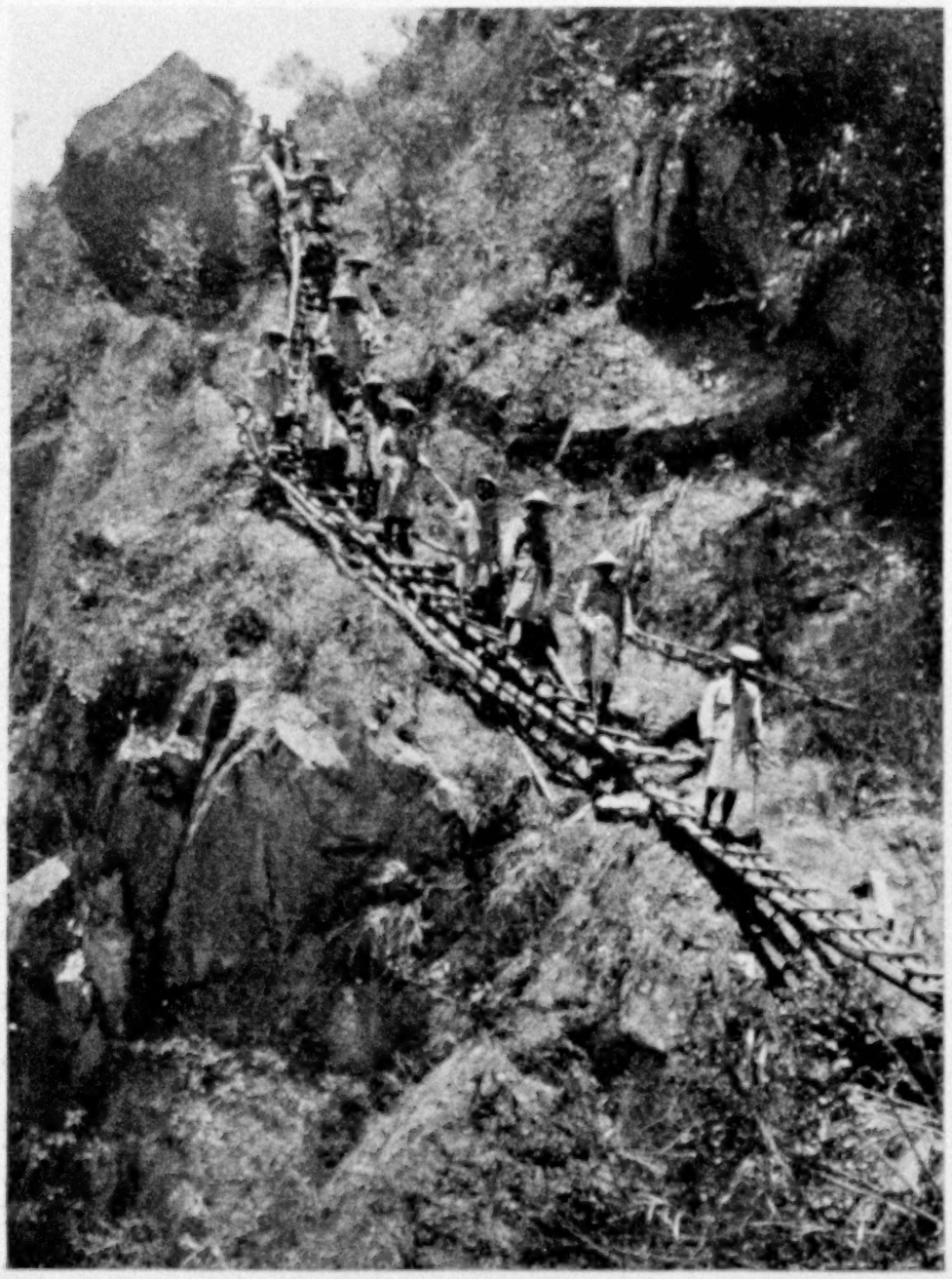
The "ripe" savages have, of course, abandoned the practice altogether, but they still cherish a sneaking affection for it, as is shown by their adherence to the old dances which originated in the festivities over the capture of heads.

In every savage village the open-air skull museum is a matter of civic pride, and most chiefs have their private collection of skulls as well.

At the time that the Chinese army of occupation left Formosa and the Japanese entered their new domain, guns were at a premium. As the Chinese residents were not allowed to retain fire-arms, nearly all the rifles belonging to the departing army, numbering about 20,000, were sold by Chinese traders to the savages. It is this possession of fire-arms that makes the head-hunters particularly dangerous to cope with.

THE LIVE-WIRE BARRIER

It is so common for some Chinaman living near the savage border to lose his head that not much attention is paid to the incident, unless his relatives band together to avenge the murder. But if some Japanese policeman, official, or soldier falls a victim, there is always an expedition to avenge his death. A village is forewarned, and if the culprit is surrendered all are spared except the guilty one, who pays the death penalty.



JAPANESE INFANTRY DESCENDING A MOUNTAIN IN THE SAVAGE DISTRICT: FORMOSA

The men employed to safeguard the camphor workers are known as "Aiyue" (Guardsmen), and their outpost line as "Aiyu-sen" (Guard-line). The line is established by cutting a path along the crest of mountains, after which the jungle is cleared away for 18 or 20 feet on both sides; guard-houses are established at strategic points and wire entanglements charged with electricity are constructed.

At present Formosa enjoys greater freedom from savage attacks than ever before in her history. This is due to the fact that the Japanese have installed a live-wire barrier from Karenko, about midway on the east coast, to Pinan, in the south, a distance of about a hundred miles, to serve as a protection against savage raids.

The trees for twenty feet on both sides of the barrier have been cleared away to prevent the savages from crossing the wire by felling trees on it.

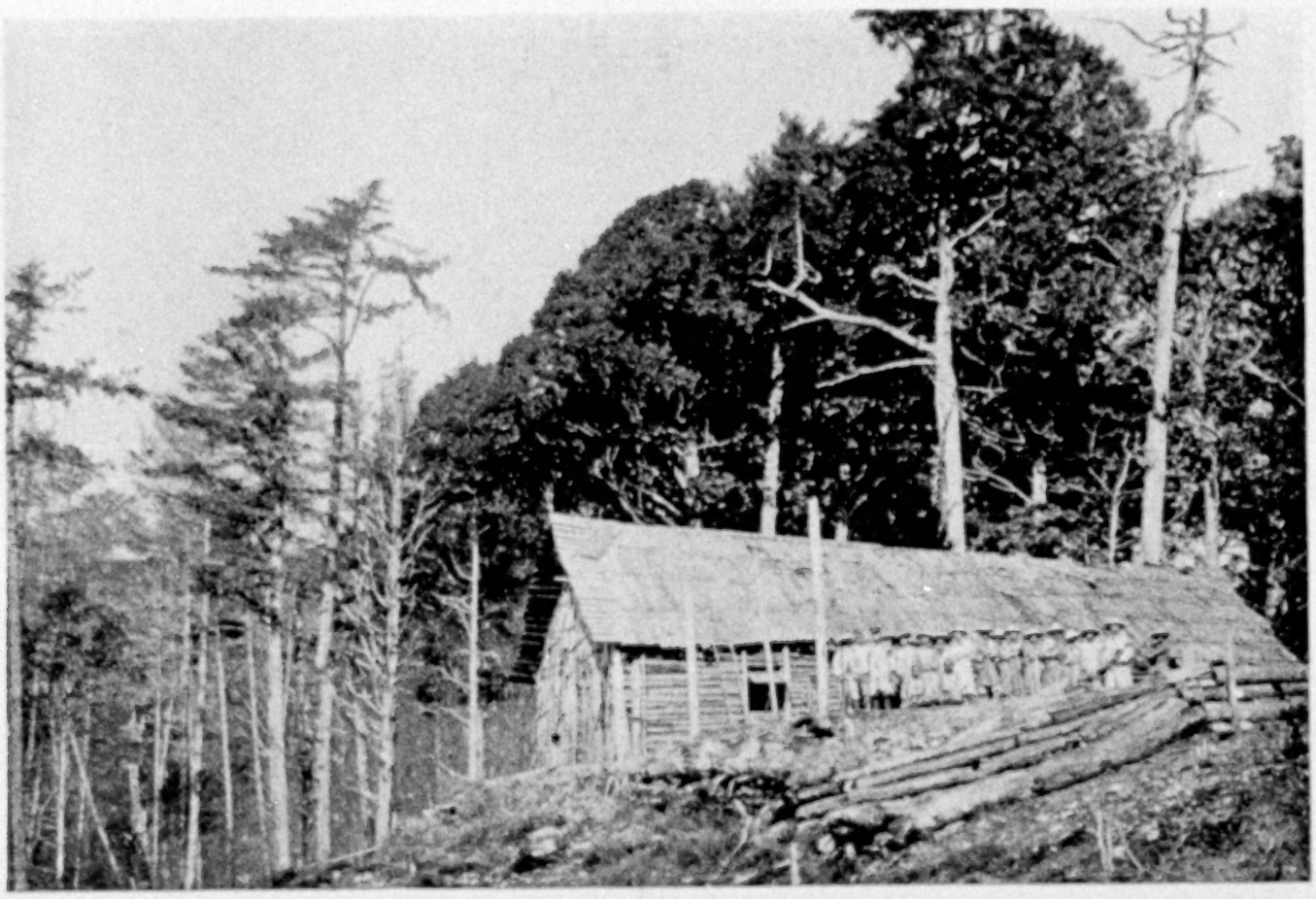
At distances of every half mile along the route blockhouses are stationed, and a sentry paces the beat between two posts all day long to see that the wire has not been tampered with or any holes burrowed underneath.

At first the electric current was turned on only at night, the usual time for a savage raid, but the wily head-hunters soon discovered this, as they noticed that no smoke issued from the power-house by day. Then, as they turned their night raids into daylight expeditions, the Japanese were obliged to turn on the current by day as well.

This device, although not exactly a cheap one, has done much to develop the fertile plain to the west of the barricade, as many Japanese agriculturists have been attracted to this region, now that they can live there in comparative safety.

Even now traders, who go as far as the barricade to exchange small wares for deer horns and tortoise shell, occasionally lose their lives, when they venture singly or are careless about going unarmed.

There are two kinds of deer, Formosa spotted deer and Swinhoë's rusa deer, that roam in large numbers on the mountains occupied by the savages, and on the seacoast back of them are found enormous turtles, varying from three to five



A MILITARY GARRISON ON THE BORDER OF THE SAVAGE DISTRICT: FORMOSA

These temporary structures serve as the headquarters of the commanding officer during an expedition against the savages.

feet in length and from 200 to 400 pounds in weight.

DIFFICULT TO STUDY THE SAVAGES

It is through a study of some newly conquered tribe that we come to know the characteristics of the Formosan savage.

Even though the ardent student of anthropology cared to risk his life among the "raw" savages, permission to enter the danger zone could not be obtained from the Japanese authorities. In fact, the Japanese are so careful in this respect that even when foreigners want to visit a village of "ripe" savages they must always be accompanied by a police escort.

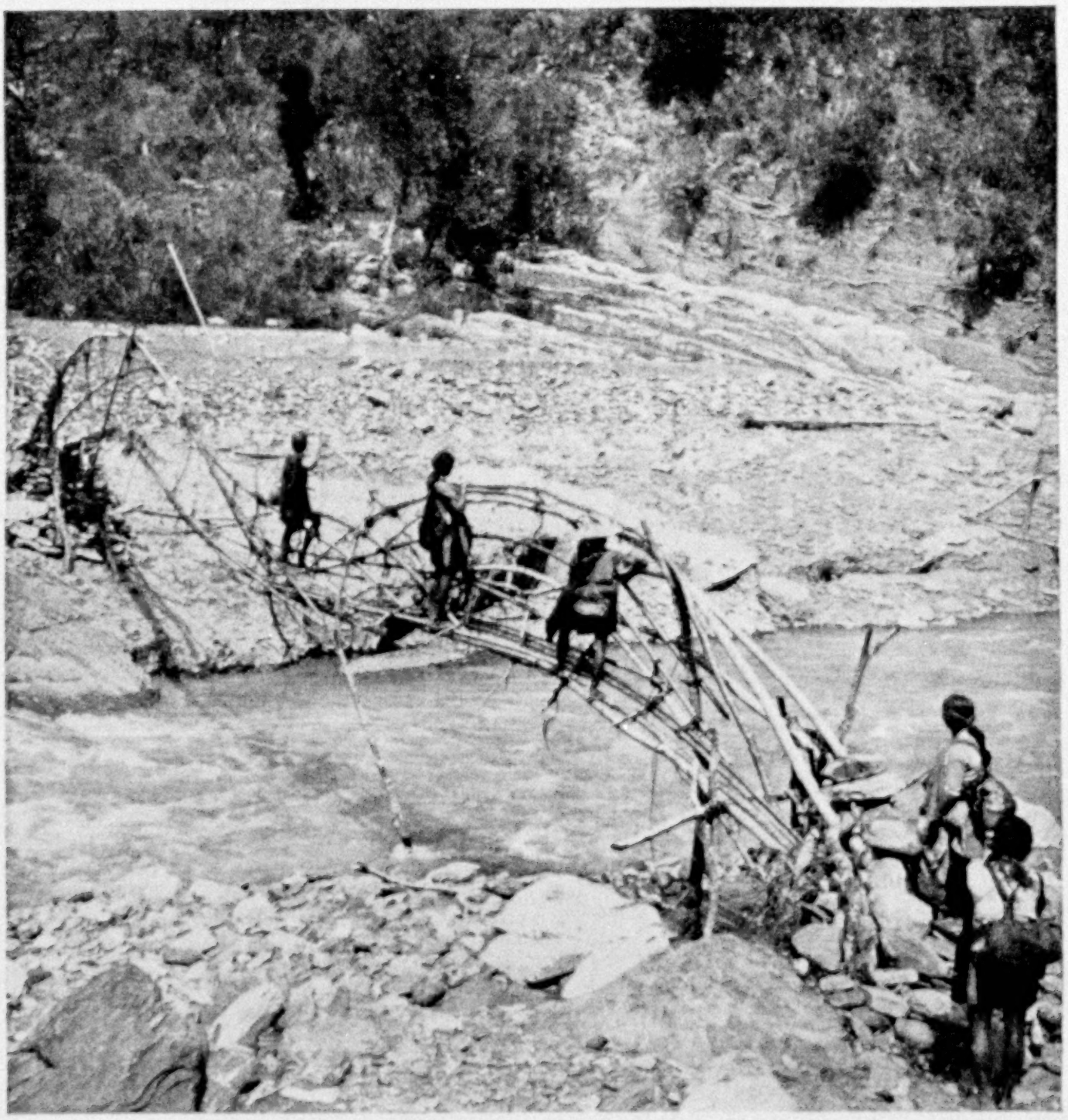
It is not my purpose here to write a descriptive history of the savage tribes on this island, having no first-hand knowledge on the subject, but I wish to relate the story of a trip I took to Kampanzan, a little savage village in the north of the island, and of an interesting encounter with Kim Soan, a savage, which throws some new sidelights on the life of his tribe, the Atayals of North Formosa.

We started out by train to Toyen, a two hours' ride, on a beautiful day last autumn. It was the time of the second rice harvest, and in the paddy-fields were scattered little groups of laborers in their broad palm-leaf hats, some reaping the grain with sickles, others threshing, and still others plowing the fields for the new seedlings.

Sunny blue skies overhead and the soft browns of the ripened grain, interspersed with vivid green patches of the young seedlings, formed the color scheme of the picture before us, and the frame was the encircling mountains.

WESTERN INVENTIONS BECOME ORIENTAL COMMONPLACES

Very picturesque were the portable tubs with their canvas awnings, looking for all the world like sails, in the wake of which followed the threshers with their bundles of grain, which they rapped smartly against the corrugated board



A BRIDGE CONSTRUCTED BY THE SAVAGES

Of course, when the heavy rains come, this bridge will be carried down-stream.

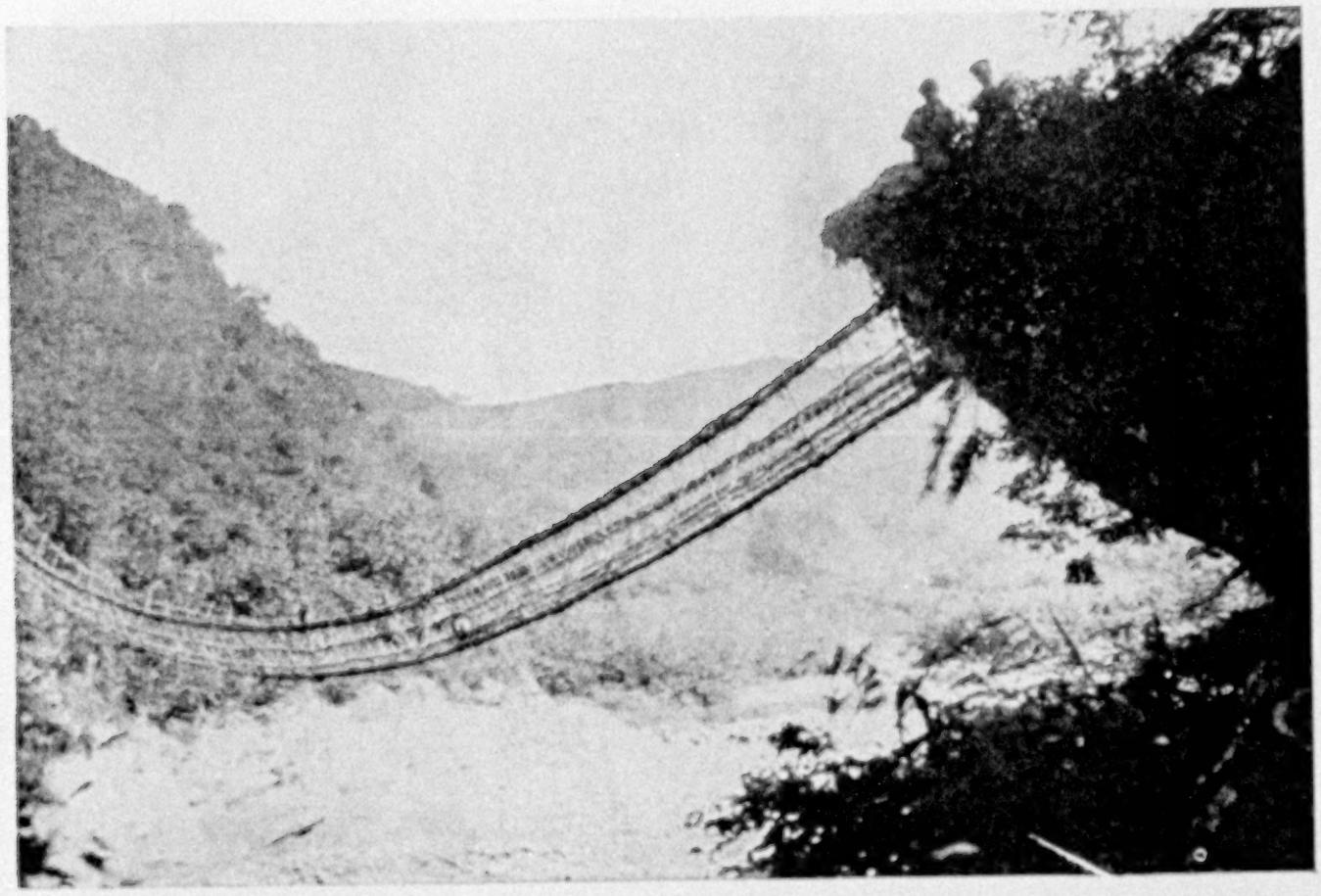
affixed to the tub, to separate the rice from the blade.

Picturesque, too, were the foot pumps, worked by three and sometimes four coolies, in pumping water from one field to another. These were the invention of a Spanish missionary and are used in China as well.

It would be interesting indeed to find out how many of the inventions of which we think as typically Oriental have originated in Western brains. I call to mind the tonga, a vehicle used all over Central India, the invention of an American missionary; and more especially the jinrikisha, the first one of which was constructed by an American missionary in Japan for his lame wife, and which is now used all over the East.

EVERY BUFFALO HAS ITS FRIENDLY HERON

The plowing is done by water buffaloes, which are brought down from their mountain pastures, where they return to graze when their work is finished. No rural Formosan landscape is complete



A RATTAN SUSPENSION BRIDGE CONSTRUCTED BY THE JAPANESE IN THE SAVAGE COUNTRY

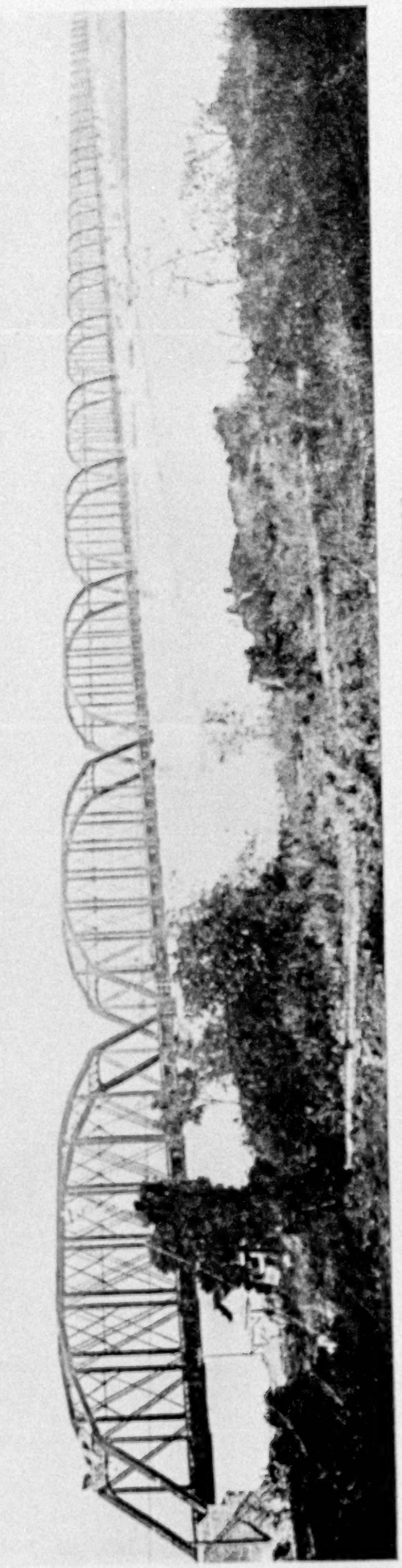
The longest structure of this kind in the island is more than 400 feet in length. Even in flood times this footbridge swings safely above the foaming waters.

MOUNT MORRISON, 13,075 FEET IN ELEVATION, THE HIGHEST PEAK IN THE JAPANESE EMPIRE

XUM

AS CAN BE SEEN FROM THIS PICTURE, AN EXPEDITION AGAINST FORMOSAN SAVAGES HAS TRIALS ALL ITS OWN

"These expeditions against the savages are never very successful, encountering as they do heavy obstacles in the way of dense forests, rapid streams without bridges, steep mountains without trails, and, above all, the danger of sudden attack."



THE RAILWAY BRIDGE AT AKO, SOUTHERN FORMOSA

Harbor improvements, railways, and bridges have greatly facilitated traffic.

without at least one of these hulking creatures, with its lowering horns and great staring eyes. Their hides are just the shade of weathered rock, and so motionless do they stand for hours while grazing on some grassy slope that they look, even from a short distance away, as if they were carved from stone.

Wherever there are buffaloes, graceful white herons are seen perched on their backs. It seems, indeed, that each buffalo has a particular heron for a pal, who takes care to rid him of smaller friends, just as devoted, perhaps, but less desirable.

At Toyen we took push-cars. These are small, wicker-covered chariots on narrow-gauge rails. The seats are just large enough to accommodate two passengers, and there is a small platform behind, where the two coolies who push the car on the upgrade can stand and ride when the route lies down hill.

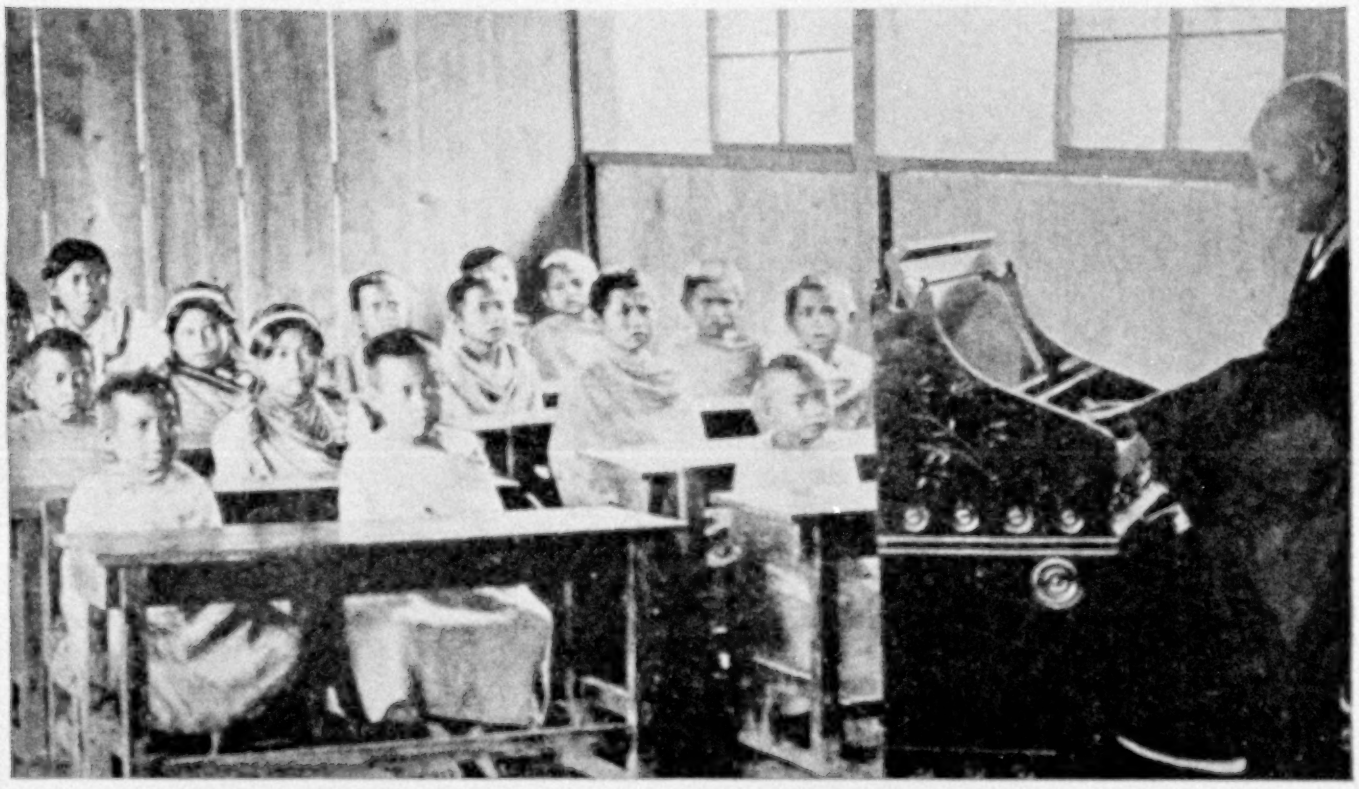
The confirmed motorist would find these push-cars a bit tedious on the level or upgrade, but going down mountains they leave nothing to be desired in the way of thrills.

Our route lay for the first hour through level country. We passed through fields of sugar-cane, with occasional patches of sweet potatoes, cabbages, and pumpkins. And now and then we came upon some Chinese village near a stream, where our approach was heralded by the shouts of children.

Women tugging small babies would hobble out of their doorways as fast as their bound feet would permit and exchange laughing comments on our appearance. Young men would frankly jeer at us, and only the old men, like figures in ivory yellow with age, gazed upon us with imperturbable calm.

A JOURNEY WITH EVERY VISTA A PICTURE

At length we started the ascent. At first our way lay through terraced tea gardens and groves of pineapples, bananas, and citrus fruits; but as we progressed the mountain sides became covered with Nature's own rich mantle. Ornamental grasses fringed our path, while through the bracken and lichened rocks projecting overhead little bubbling freshets trickled down at our feet.



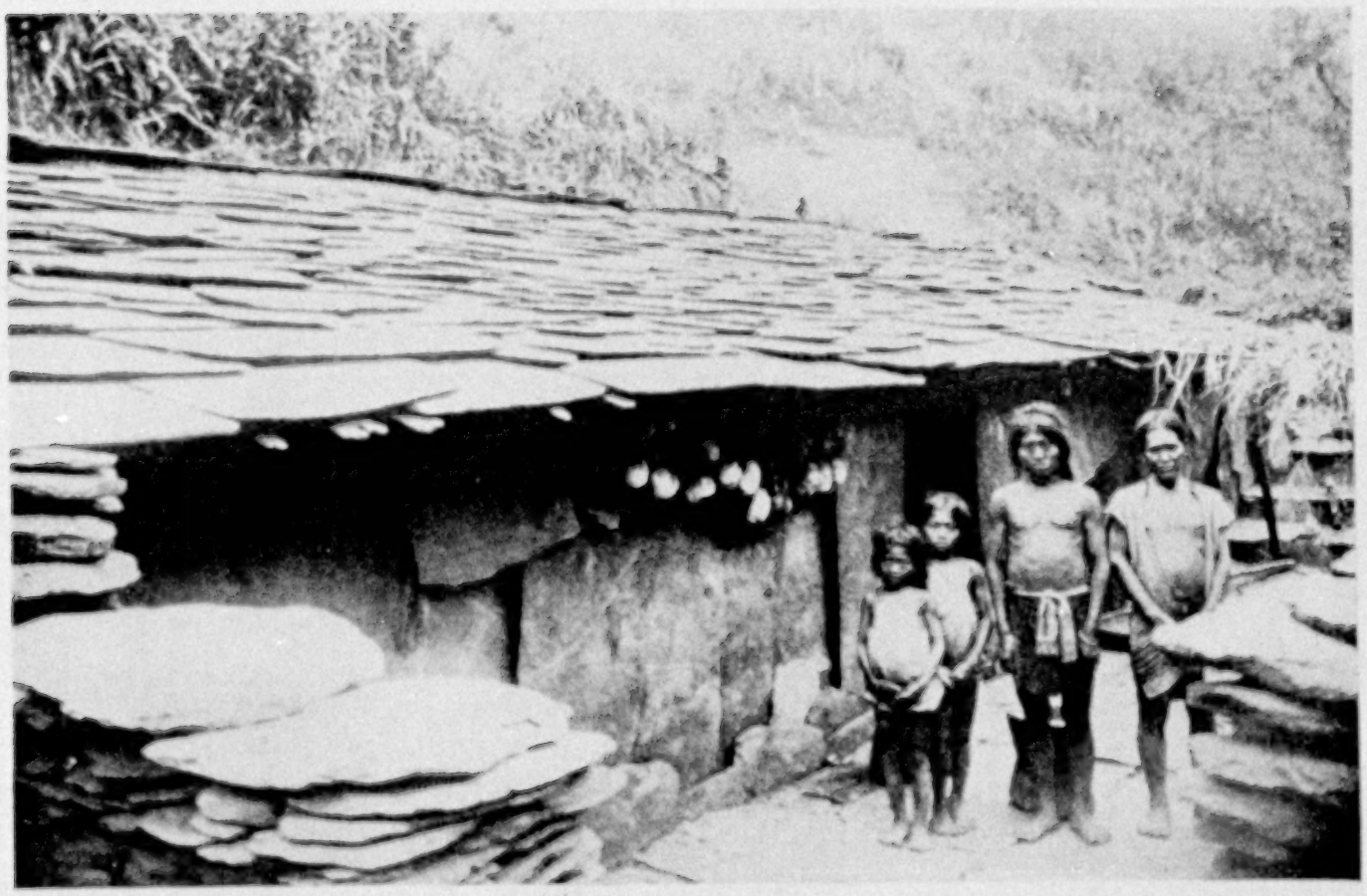
THE SCHOOL FOR SAVAGE CHILDREN AT KAMPANZAN, A MOUNTAIN VILLAGE IN NORTHERN FORMOSA

A SAVAGE PALAVER-HOUSE

Most of the savage groups have these dwellings, which serve the double purpose of club-houses and bachelor dormitories.

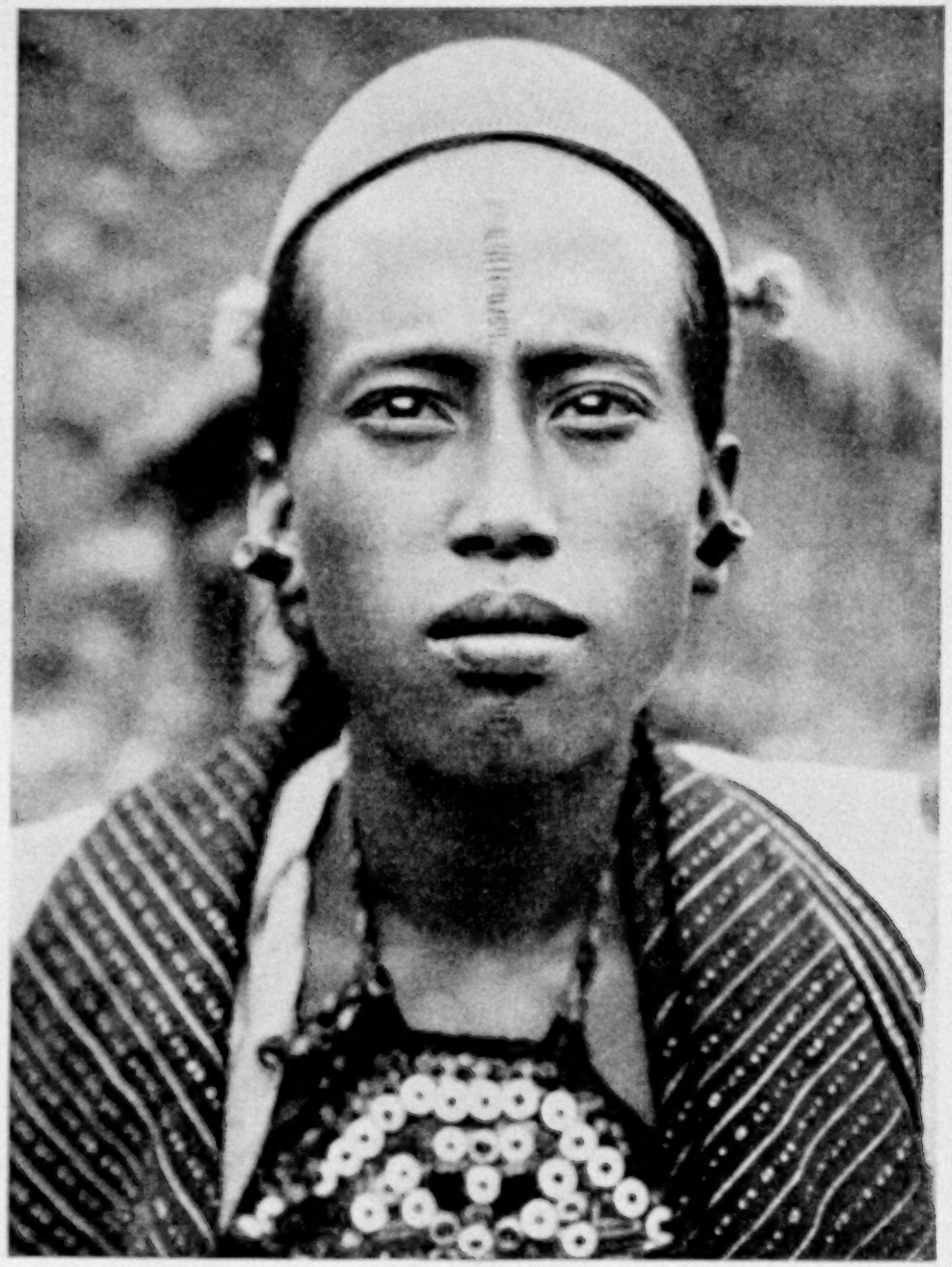
A THATCHED-ROOF TYPE OF SAVAGE DWELLING

These natives are displaying some of their hand-made pottery.



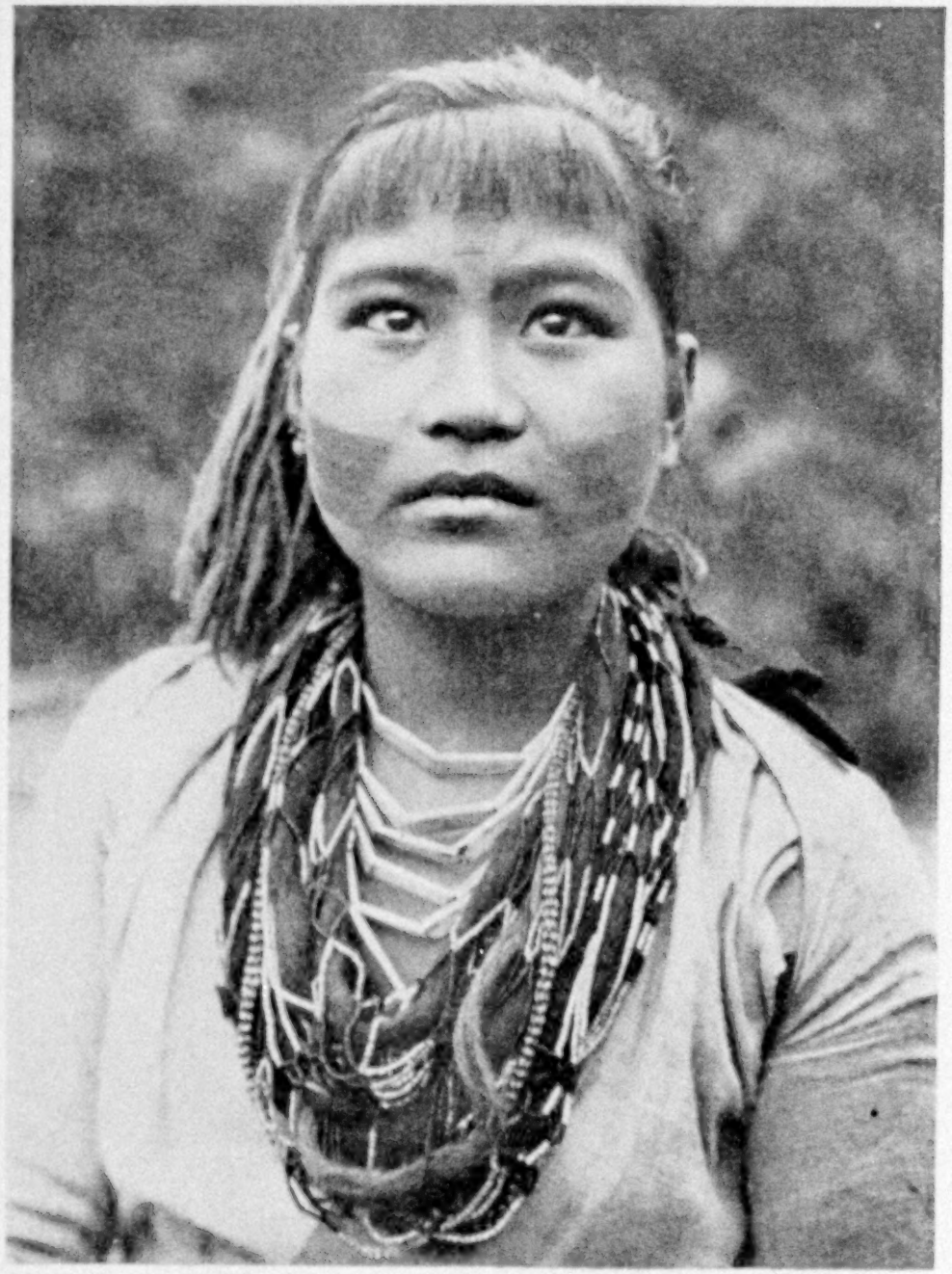
A SAVAGE DWELLING WITH SKULLS HANGING FROM THE RAFTERS

Whenever savages live in the vicinity of slate quarries they construct their homes from slabs of slate.



THE DEEPLY DENTED TATTOO-MARKS INDICATE THAT THIS ATAYAL SAVAGE HAS ATTAINED MANHOOD'S ESTATE

It is perpetual leap-year in the Atayal country, for the woman has an equal right with the man to choose her mate, the bride prospective going to the house of the man or he going to hers. No one is allowed to have more than one partner or to marry into another tribe.



A WOMAN OF THE ATAYAL GROUP WHOSE TATTOOING DENOTES THAT SHE IS OF MARRIAGEABLE AGE

Both the men and women of this group are fond of necklaces and bracelets and other ornaments made of the teeth of animals, hard red berries, brass and other metals. They remove from the upper jaw the two lateral incisors to improve their appearance.

Every bend in the path brought to view some new slope more exquisitely arrayed than the last—a profusion of tropical foliage plants, elephants' ears, plantains, and tree-ferns intermingled with flowering shrubs of many varieties, wild hydrangeas, morning-glories, pink oleanders, hibiscus, and the lovely gold-banded lilies of Japan.

Kampanzan itself is not over 2,000 feet in elevation, but the mountains surrounding it form a splendid setting, the lower hills densely wooded and the higher veiled in clouds and snow.

Toward dusk we arrived at the savage village, tucked away in a valley between two mountains. Smoke clouded the doorways of the mud, grass-roofed huts, for within savage mothers were boiling their evening meal of sweet potatoes over wood fires in the center of the floor.

Children ran out at our approach, their eyes quite wet and streaming tears from their recent smoke bath, while their sires, one-time braves, but now mere blear-eyed phantoms of savagery, squatted in front of their houses and blinked at us, as we passed, between puffs from long thin pipes.

THE STORY OF KIM SOAN

We went to a small Japanese inn, and it was here that we met Kim Soan, after we had finished supper and were wondering how to spend the hour before bedtime.

He came as the messenger from the chief police official to inquire whether we had everything we needed for our comfort. A member of our party, who has lived many years in Formosa and speaks fluent Chinese, requested him to convey our thanks to the police official, and then return to us for a talk. After he had gone our friend said, "I know that man; his face comes back to me," and he told us what he knew of Kim Soan's history.

When the Chinese were still in possession of Formosa—a period of gross misrule, from all accounts—there seems to have been one governor with a few advanced ideas. He conceived the scheme of educating the young boys of conquered savage tribes and sending them back as apostles of light to their people. But he reckoned without the volition of his pupils, as in the case of Kim Soan, who was one of these boys, and who after he had become attached to the amenities of civilization refused to return to savagery.

Later, when the Japanese came to the island, Kim Soan was commissioned to accompany two Japanese officials who were going to enter the savage territory to take the census. The three set out, all dressed alike in Japanese garb, and they had not proceeded very far when they were attacked by some savages, who killed the two Japanese, but spared Kim Soan.

He returned to report the murders to the authorities, and they, in turn, condemned him to die, deeming him responsible for the two deaths. He managed to escape, however, and fled to the mountains, where he stayed for eight years. Then he received his pardon, returned to the plains, and was made an instructor in the school for savage children at Kampanzan.

"HOW MANY HEADS DID YOU CUT OFF?"

Our companion had hardly finished this narrative when Kim Soan himself reappeared. The conversation which took place between the two follows:

"Don't you remember me, Kim Soan, and the little school at Tamsui that you used to attend?"

"Oh, sir, that is a long time ago—so long that it seems like a dream."

"So you became a savage again. How many heads did you cut off?"

This remark had the effect of a bomb. Instantly Kim Soan leaped to his feet, and raising his hand, his voice choking with emotion, said very solemnly, "I swear by the heavens above and the earth below my feet that I have never been guilty of taking any human life."

"But you have the tattoo-marks on your forehead that indicate that you have been admitted into the council of the men of your tribe. Surely you must have procured at least one head to enable you to accomplish that?"

Again he asserted his innocence with the same impressive solemnity.

"Then you must have accompanied the others on some head-hunting raid. You couldn't refuse to go, could you?"

Photograph by T. MacGregor

A GROUP OF KAMPANZAN SAVAGES

The savages in the northern half of the island are distinguished from the southern natives by their tattooing. The southern savages are not given to this practice. Of the northern tribes the one scattered over the largest area is the Atayal group, to which the Kampanzan savages belong. They live in mountain recesses, are among the least civilized of all the inhabitants of Formosa, and are especially partial to head-hunting.

"No, I couldn't refuse. I always tried to find some excuse, but finally our chief said, 'Tomorrow you go.' Then we shook a tree full of birds to read the omens from their flight, and the old woman of our tribe said, 'It is well; you will be successful.'

THE DOUBLE ASSASSINATION

"That night I went to bed with a heavy heart, and when I slept I dreamed that we would meet a woodsman with an axe and a guardsman with a rifle.

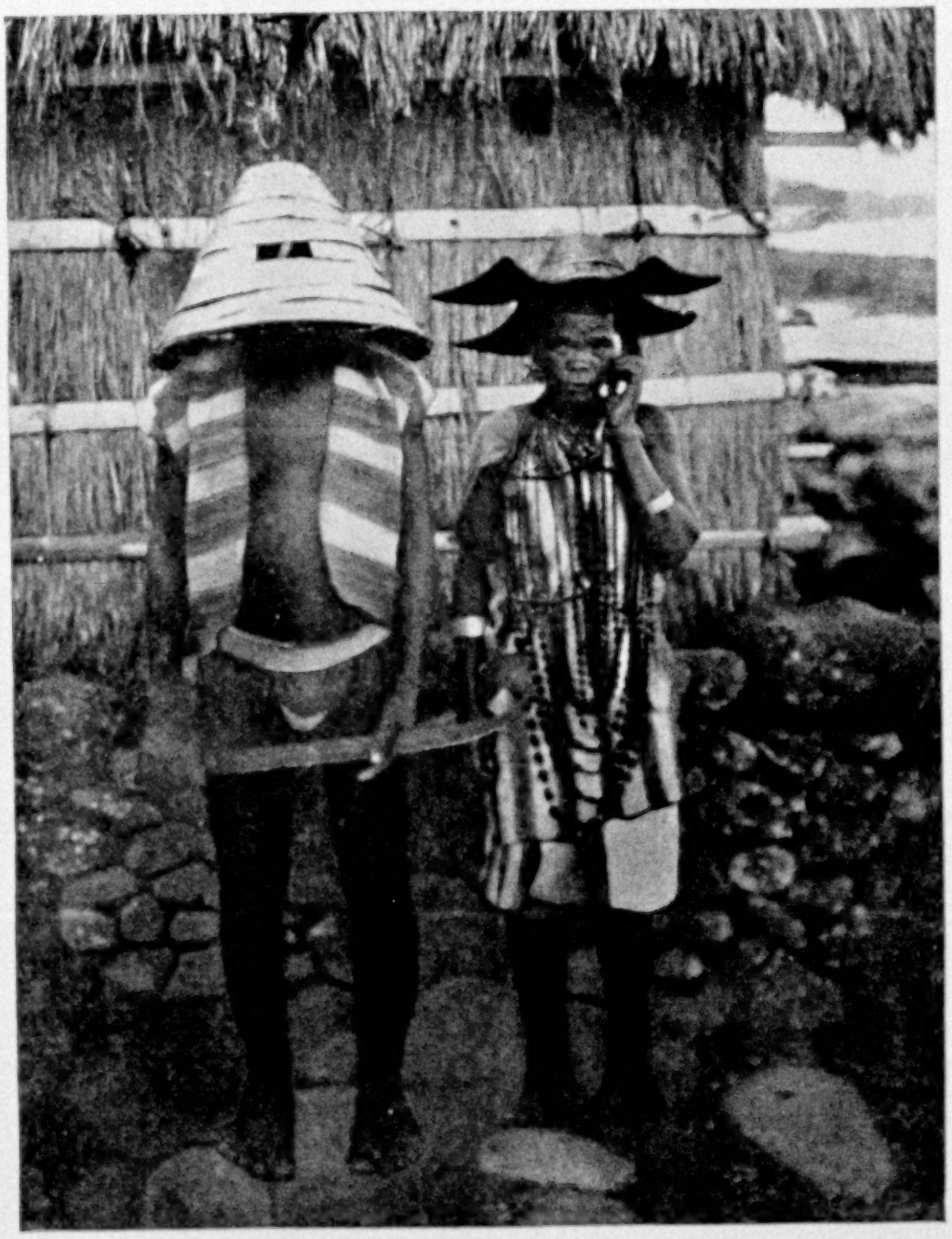
"On the next day it turned out even as I dreamed. My companions shot the guardsman through the heart from an ambush ten feet distant, and the woodsman threw up his hands and begged for mercy.

"I pleaded with my companions to spare his life, and they said, 'Fie! shame upon you! You have a Chinese heart.' Then

they turned upon me to kill me as well, so I withdrew my petition. After that they cut off the woodsman's head, and we returned home."

"And didn't you take part in any more raids after that?"

"Yes, one more. Once we lay in ambush in some tall grass as some Japanese infantry were coming along. They were very brave, those men, for though we shot down the first ones, the others kept right on coming. Soon, however, we were forced to make our escape, for they far outnumbered us. We respect the courage of the Japanese soldiers, but the Japanese policemen — bah! they scuttle away like mice at the first glimpse of us."



HOW WOULD YOU LIKE TO MEET US IN THE DARK?

An old savage chief and his wife. The former was told to dress up as he would to go on a head-hunting raid.

WOODEN BULLETS THAT EXPLODE

Then we asked Kim Soan many questions, and he gave us many interesting answers. He told us of the blacksmiths of every tribe who kept the guns in good condition. He contradicted the rumor that arms and ammunition are still smuggled into the savage territory.

He related to us how the savages make bullets from the heart of a very hard wood cured by a special process. These bullets are only effectual when fired from a short range, and when they lodge in the flesh they explode like dumdum bullets.

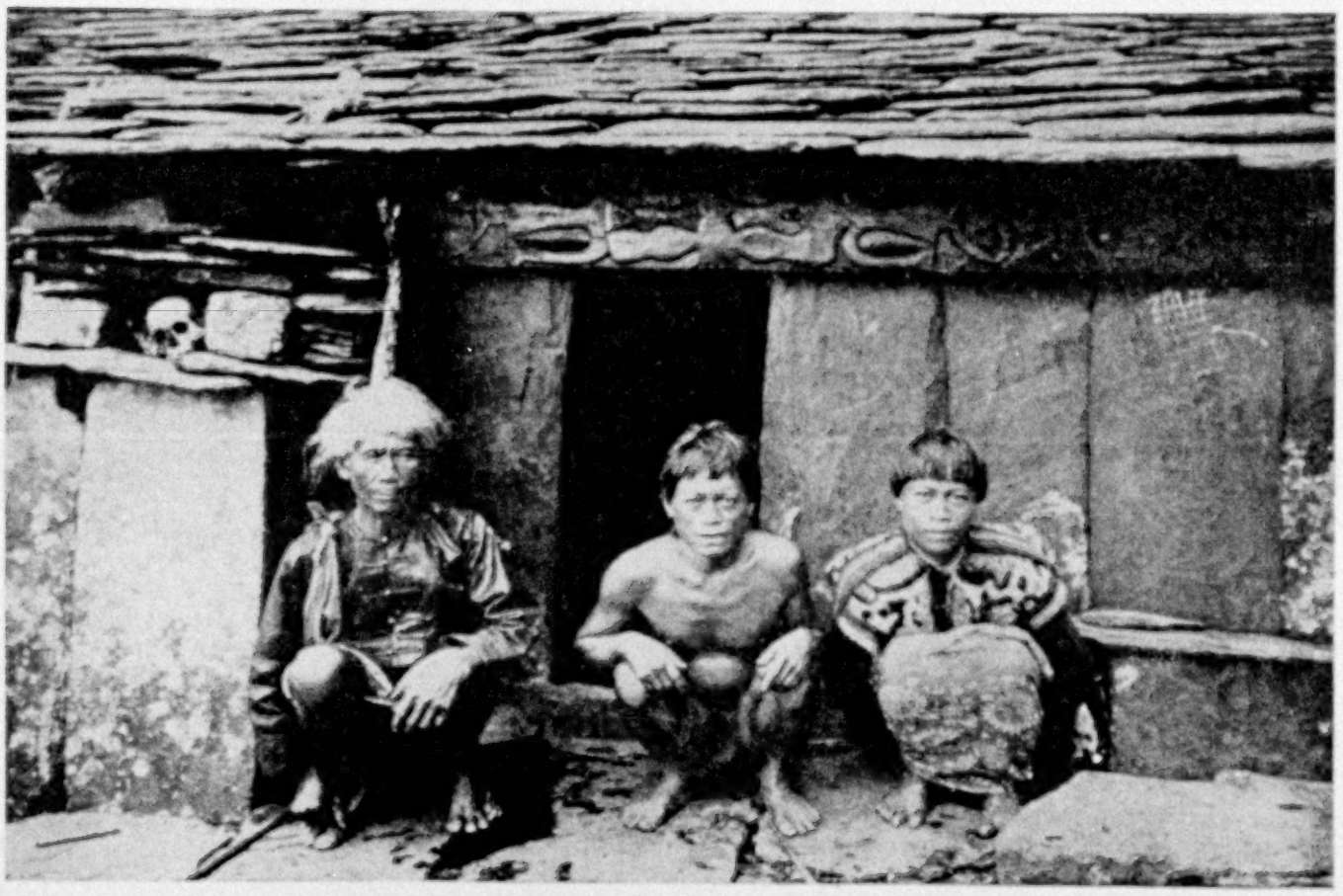
He also explained to us the ingenious way in which the men of his tribe make caps. Two small disks are cut from the striking side of a safety match-box, the tip of a match is placed between, and then the disks are glued together. He told us that they were always able to buy as many matches as they wanted from Chinese traders.

For hunting birds and beasts, he stated, bows and arrows were used, and all their ammunition was saved to hunt men.

THE BLOODY HAND A PASSPORT TO THE SAVAGE HEAVEN

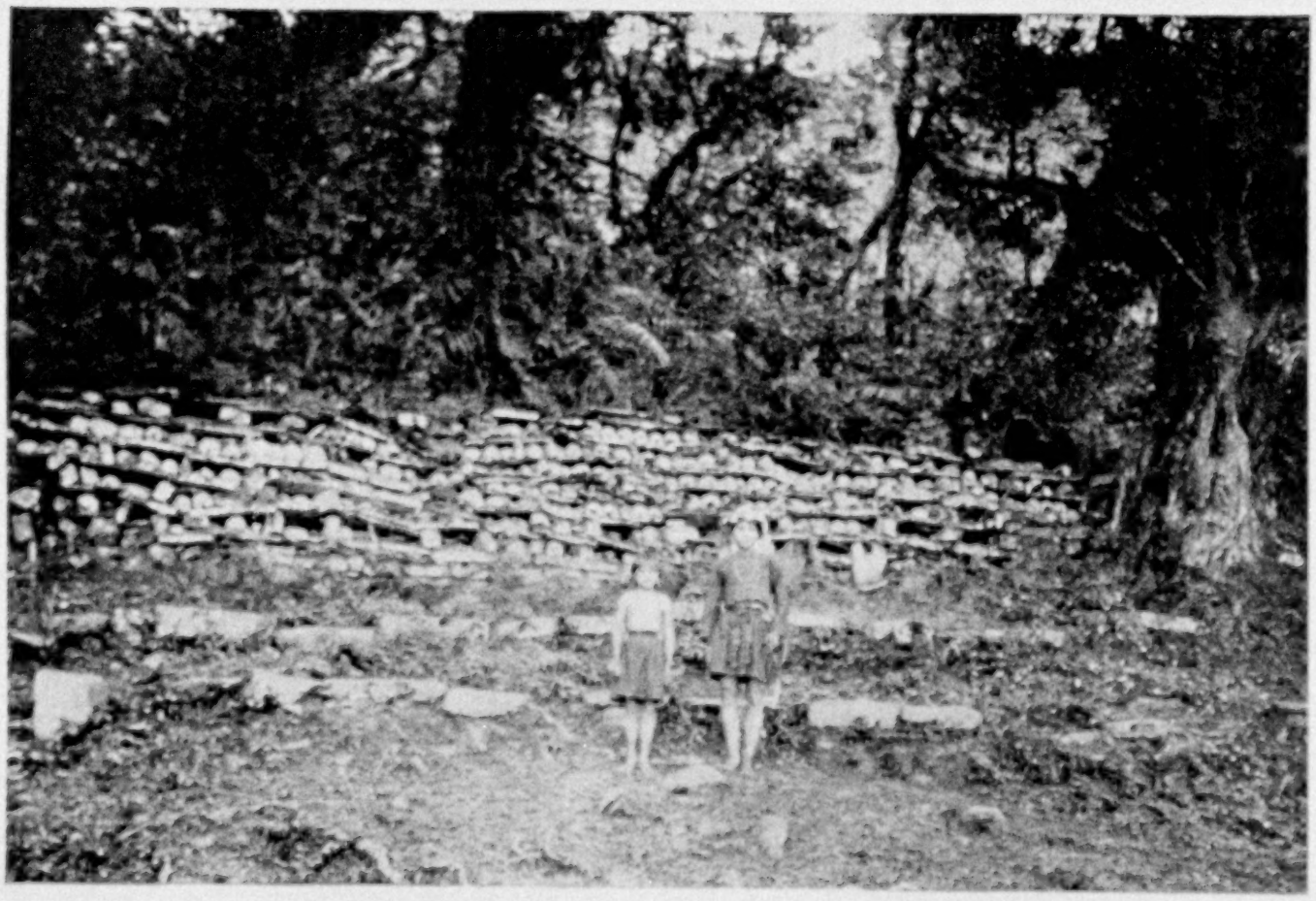
"But why do your people hunt heads? Is it true that a man must procure a head before he can claim a bride?"

"No, it isn't that; but, of course, the women prefer the men that have brought back the most heads. But it's this way:



THE HOME OF A SAVAGE CHIEF: FORMOSA

In nearly all the savage groups the home of the chief is distinguished by the crude carvings of human figures over the doorways. Note the skull on the shelf at the left.



AN OPEN-AIR SKULL MUSEUM

"In every savage village the open-air skull museum is a matter of civic pride."

all my people believe that when we die we all must walk up the rainbow to the Land-of-After-Death.

"At the end of the rainbow the gateman stands, and when we come he will say to us, 'Show me your hand.' And he will look at our hand, and if he finds it clean he will say, 'Go to the right,' and he will kick us into the dark nothingness below; but if he looks at our hand and finds it stained he will say, 'You may enter,' and he will allow us to pass within."

JAPANESE SCHOOL FOR SAVAGE CHILDREN

Before we left Kampanzan we visited the savage school in which Kim Soan was a teacher. The children sang the Japanese national anthem for us with very pleasing voices. I have never heard Japanese or Chinese children sing half so well.

Then several of the children made speeches, which were very amusing, as they were so obviously the product of the teacher's pen. Each speech started somewhat as follows: "I am a poor little savage boy. Before the kind Japanese came here, I was very ignorant. Now my kind teacher is teaching me many things," and more of the same sort.

The Japanese are taking steps to train the savages in certain manual arts, chiefly cloth-weaving on hand-looms, so that they can earn their living, now that they can no longer follow the more exciting life of the chase.

I left Kampanzan with a feeling of depression. There is something poignantly pathetic in the spectacle of these wild creatures of the forest tied down to a dull domesticity, even as wild beasts captive in cages.

"ALAS, POOR YORICK, I KNEW HIM WELL!"

A nearer view of a skull museum, showing the trophies placed on bamboo poles.

FORMOSA ONCE THE STRONGHOLD OF JAPANESE AND CHINESE PIRATES

The bulk of the population of Formosa is, of course, Chinese. Several centuries ago the island used to be the stronghold of both Chinese and Japanese pirates, who found it a very convenient base from which to intercept vessels following the trade routes between Japan and the rest of the Orient.

It was not until the fourteenth century

SAVAGES CARRYING WATER IN BAMBOO POLES

This practice is only one of many points of resemblance between Formosan savages and South Sea tribes.

A SAVAGE WOMAN WEAVING CLOTH ON A HAND-LOOM

BLACK TEETH AND FLAT, ROUND BAMBOO EARRINGS ARE HIGHLY PRIZED AMONG THE SAVAGES OF THE PAIWAN GROUP OCCUPYING SOUTHERN FORMOSA

It was upon the Paiwan savages that the Japanese wreaked a bitter vengeance in 1872, following the massacre of a crew of shipwrecked Japanese sailors.

FANTASTIC EFFECTS IN MILLINERY DISTINGUISH THE ORNAMENTATION OF BOTH MEN AND WOMEN OF THE TSUO GROUP

This tribe has a unique organization. All the land is owned by one clan, the Hyofupa, to whom every tribesman gives a tithe of his annual harvest. A public council hall, called the Kutsuba, is used as a lodging place for all unmarried youths more than 12 years of age. These boys are subjected to Spartan hardships in training to foster discipline, courage, and virtue.

THE BELL-SHAPED EARRINGS AND CHAPLETS OF BONE AND BEADS INDICATE THAT THESE SAVAGES BELONG TO THE VONUM GROUP

According to a tribal legend, the Vonum Group of Formosan mountain savages lived in the plains until the misfortune of an all-destroying deluge befell them. With the flood came a huge serpent, which swam through the stormy waters toward the terrorized people. They owed their deliverance from the great snake to the timely appearance of a monster crab, which, after a terrific battle, succeeded in killing the reptile.

that the first industrial class of Chinese, the agriculturist Hakkas, who were outcasts in their own country, came to settle in Formosa. After that, at the time of the Tatar invasion, several thousand Ming loyalists sought refuge on the island.

Then there has always been more or less of an influx of immigration from the overpopulated province of Fu-kien, just across the Formosa Straits. These Chinese from Fu-kien far outnumber the others, and their speech, known as the "Amoy dialect," is the vernacular of the island.

When the Japanese came into control of the island after the Chino-Japanese War, in 1895, a third element was added to the population.

THE WORK OF THE JAPANESE

The Japanese have instituted great material improvements in Formosa. The most important, of course, are the modern courts of justice in lieu of the old mandarin courts, where the man with the greatest "pull," which, needless to say, spelled money, invariably won out. There is also greater security to life and limb now, for not only is the Japanese police system a most thorough and efficient organization, but the sanitary measures that they have adopted have practically eradicated such diseases as malaria and bubonic plague.

AN ERA OF PROSPERITY

Harbor improvements, railways, and bridges have greatly facilitated traffic, but the road systems, as yet, outside the city of Taihoku, leave much to be desired.

Education, too, has been advanced, but, owing to the policy of assimilation, native schools are not encouraged, and the percentage of Chinese children at-

A DANCE OF THE AMI GROUP: FORMOSA

The Amis have discontinued head-hunting, but they still adhere to the old dances, which originated in the festivities over the capture of heads.

WOMEN WATER-BEARERS OF THE PEPO GROUP

The members of this group are scattered over the broad tracts of level land in the western parts of Formosa. They long had intercourse both with the Dutch and the Chinese. Today they are scarcely distinguishable from the Chinese.

YOUTH AND OLD AGE

This tattooed design is peculiar to the Tsalisen Group, whose members ceased to hunt heads more than a century ago. They are now good farmers, and through their frequent intercourse with the Chinese have become skillful blacksmiths and carvers. Many of the women of this tribe wear dresses with long trailing skirts.

tending public schools is only a little over 13 as against a rate of over 95 for the Japanese children of the island. Opium smoking is controlled by license. About 2 per cent of the Chinese at present smoke opium, but eventually this will stop entirely.

The future of Formosa under its present benevolent paternal government looks bright, indeed. Never before has this island, so beautiful to the eye, enjoyed such a degree of prosperity. Old industries are thriving, new industries are cropping forth, foreign trade increases yearly, and the general welfare of the Formosan people is steadily improving.

NATIONAL GEOGRAPHIC SOCIETY NOTICE

The Board of Managers of THE NATIONAL GEOGRAPHIC SOCIETY report to the members the following proposed changes in the By-Laws of the Society:

That Section 2 of Article VII of the By-Laws be amended to read as follows:

"The annual dues of members shall be $2.50, payable in January.

"This amendment shall be effective as of January 1, 1920, but shall not apply to members who have paid their dues prior to its adoption."

That Article XII be amended to read as follows:

"These By-Laws may be amended at any meeting of the Board of Trustees by a two-thirds vote of the members present; provided, however, that notice of intention to amend said By-Laws has been sent to all members of said Board not less than thirty days prior to such meeting."

That Section 1 of Article IV be amended to read as follows:

"The direction and management of the affairs of the Society and the control and disposal of its property and funds shall be vested in the Board of Trustees, twenty-four in number. The Trustees shall hold office continuously. All vacancies in the Board of Trustees shall be filled by the Trustees."

A special meeting of the members of the Society is hereby called and will be held on the 15th day of March, 1920, at Hubbard Memorial Hall, Washington, D. C., at two o'clock p. m., for the purpose of voting on the above amendments.

By order of the Board of Managers:

O. P. AUSTIN, *Secretary.*

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Ypres

We will be pleased to send you gratis our booklet "The American Traveler in Europe—1920." It Solves the Problem.

THE British Tommies called it "Wipers"—this little West Flanders town, with its fine Cloth Hall, where in the days before the war the linen and lace trade flourished. Ypres was bombarded time and again by artillery, both of the Germans and Allies, and during the war its streets were deserted of all save rumbling motor-lorries or ambulances scurrying away from the explosion of the great shells. But when you go to Ypres today you'll find a city reborn.

All through Belgium—anywhere on the Continent or in England—there is one form of travelers' funds that receives instant recognition at any time. The long use of

American Express Travelers Cheques

makes them as readily acceptable as the currency of any country. Wherever you can spend money there you can spend American Express Travelers Cheques. They are convenient to carry and are insured against loss or theft.

You can buy American Express Travelers Cheques at your bank or the nearest American Express Company's office.

They are part of the service our Travel Department is ready to render you. Write for details as to conducted tours, itineraries, etc.

Travel Department

AMERICAN EXPRESS COMPANY, 65 Broadway, New York City

Let Sound Investments guard your home

WHEN you build your home, you consult a capable architect as a matter of course. In building your financial estate, for safety's sake, seek experienced investment advice. You can have it for the asking.

When we tell you that, in our judgment, certain securities are right for you to buy, we tell it only after a strict investigation of the values, products, purposes and people back of such securities.

We invite you to call at the nearest of our 50 correspondent offices and learn about the investment securities we recommend for you—you at your age, your circumstances, your purposes, your ambitions—in a word, for *your* needs. We have investment securities for every need.

Meanwhile, let us send "Men and Bonds"—the illustrated story of our investment service—together with our latest Offering Sheet. Mailed promptly on request for AN 119.

The National City Company

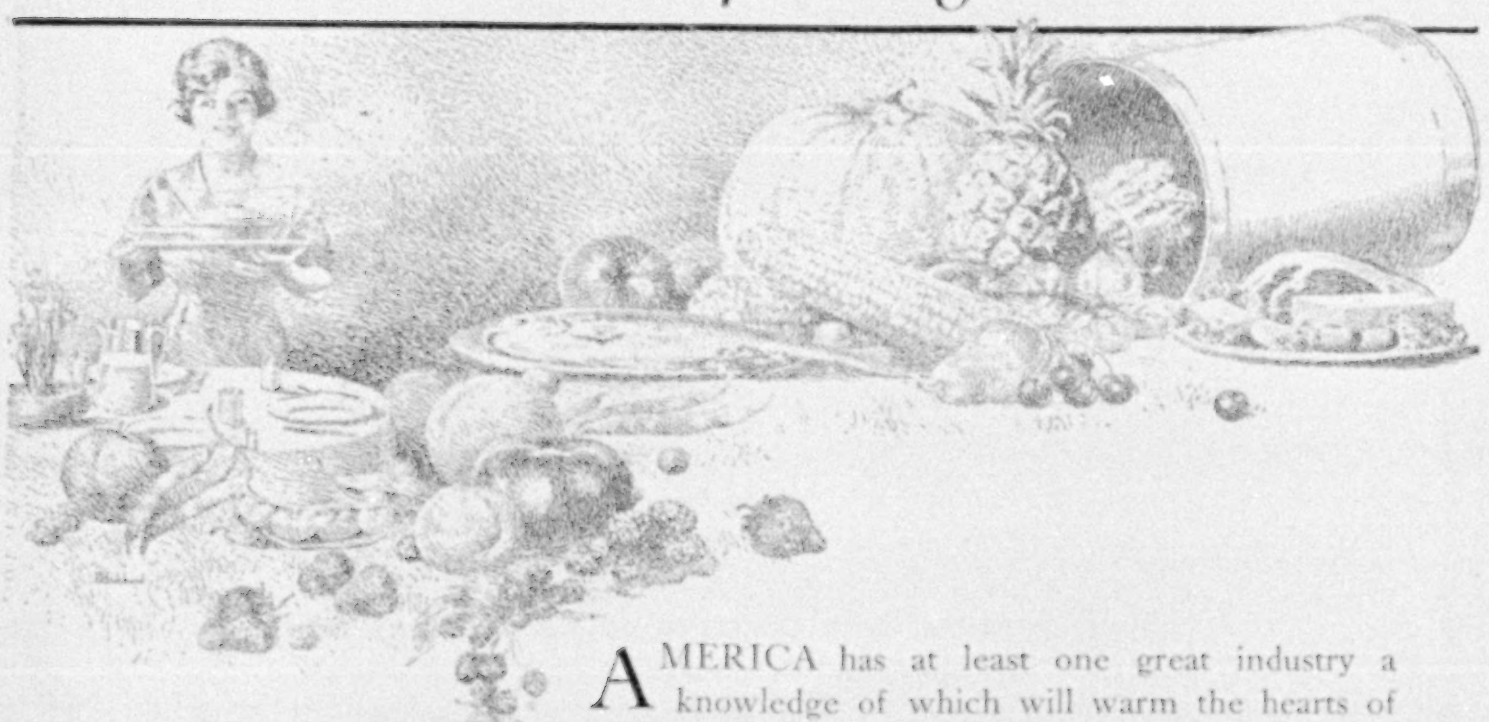
National City Bank Building, New York

A NATIONAL INVESTMENT SERVICE—*More than 50 correspondent offices in the leading cities connected by about 10,000 miles of private wires*

THE NATIONAL CITY COMPANY
NATIONAL CITY BANK BUILDING
NEW YORK

"Mention The Geographic—It identifies you"

A Canned Food Message -especially to Women



AMERICA has at least one great industry a knowledge of which will warm the hearts of all woman-kind.

Salute the canned food on your pantry shelf. The Pure Food Laws—commendable and necessary though they are—are yet far exceeded in the requirements which the great organized food canning industry of the United States lays down for itself.

Think what such Protection means to our tables!

You whose important duty is the selection of the food that goes on the family table, remember this:

All over the United States there stretch the great organizations of the Pure Food Laws, Federal and State, working hand in hand.

All over these same United States there stretches from Washington—from the headquarters there of the National Canners Association—another great

© 1920 National Canners Association

pure food organization—the voluntary Inspection Service of the National Canners Association.

Not how Little it Must do—but how Much it Can do

This is not an arm representing force or compulsion. Rather, it represents a united ambition on the part of a vast industry to keep itself in spirit and in practice above any necessity of laws of regulation.

Little wonder, then, that the canning industry has been called "the industry which legislates for itself"! Never does this industry forget that it is dealing with *food*—with food, the thing of such vast consequence to the little family circle of the American home. In a very real way it realizes its responsibility and in a very real way it faces its responsibility.

If only you could See it all for Yourself

Every American housewife should have the privilege of following through some of the great canneries of fruit, vegetables, soup, meat, sea food, milk, and other products. Follow the Inspector of the Association as he passes, on one of his visits from the supply of fresh foods to the sorting, cleaning, preparing; follow the Inspector all the way through to the sealing of the cans, the final cooking, cooling, and storing away.

The Inspector represents a system which constantly, and at great expense, searches out the latest scientific facts of importance to this vital work of supplying the family table. He is a symbol of the painstaking care with which the canning business is conducted. He represents the earnest determination of the industry to supply our families with the best of food—clean, wholesome, nourishing, and safe.

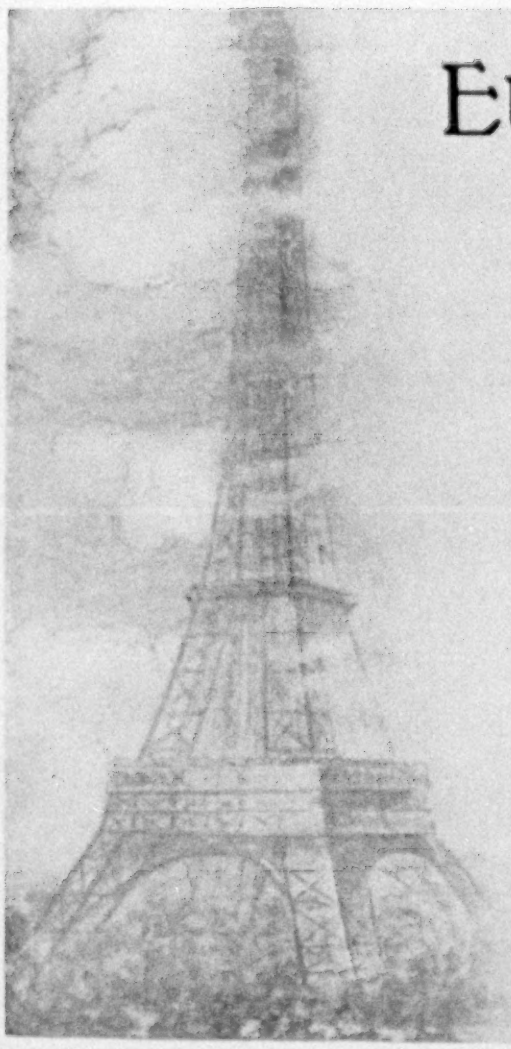
Canned Food—"The Miracle on Your Table"

And so may American housewives, mentally at least, salute the most self-respecting of objects, the can of food. You are standing before a very wonderful thing—a product which knows the limitations of neither climate nor season, coming to you at any time and from any place. Richly it deserves its title—"The Miracle on Your Table."

National Canners Association

WASHINGTON, D. C.

A nation-wide organization formed in 1907, consisting of producers of all varieties of hermetically sealed canned foods which have been sterilized by heat. It neither produces, buys, nor sells. Its purpose is to assure, for the mutual benefit of the industry and the public, the best canned foods that scientific knowledge and human skill can produce.



EUROPE IN 1920

THERE have always been many incentives to travel abroad—rest, recreation, desire for familiarity with the enjoyment of the historic spots, the architectural monuments, the art treasures of the Old World. This year there is added to all these existing appeals, a new force that draws one's eyes and heart to the rising sun. It is the desire to pay homage to those who have fallen, and see with one's own eyes the scenes of the world's greatest war.

Our large organization has acquired the most valuable practical experience in connection with the special conditions existing to-day and is completely prepared to give the smooth-working, helpful, comfortable service for which the name of Thos. Cook & Son stands.

Send for schedules: itineraries include France, Belgium, Switzerland, Italy, Holland, Great Britain, etc.

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Now It's SWITZERLAND Again

The land of unlimited possibilities for the vacationists.

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ATLIN AND THE YUKON

See this wonderful Northland. The one trip you will never forget and never regret.

You travel in perfect comfort all the way. Best of ocean steamers. Parlor observation cars. Modern river steamers. Excellent hotels and service.

Interesting booklets, maps and worth-while information on request.

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J. L. BURNSIDE, Gen. Agent, 616 Second Av., SEATTLE, WASH.

WHITE PASS AND YUKON ROUTE

ZELNICKER'S BULLETIN

88 pages—get a copy before buying

RAILS

Locomotives, Cars, Tanks,
Heavy Machinery, Boilers, Engines,
Pipe, Piling, etc.

ZELNICKER IN ST. LOUIS

THE prosperity of present-day New England is due in no small measure to the continuance of this old spirit of the bootmakers of Boston.

The policy of "good work and pride in it" has been the cornerstone of success for Lynn, Brockton, Haverhill, Boston, Manchester, Auburn, and Lewiston. So that today over half the nation is shod by New England.

Not only in the shoe industry, but in other lines, the outstanding feature is soundness, and investors the country over are appreciative of this quality in New England industries—a heritage of the old "payment-in-full" spirit of the original Plymouth settlers, who bought up in seven years all the stock in the London Company which financed the colony.

New England's reputation for stability and integrity has led many non-residents to put their securities in trust with the Old Colony Trust Company, a practice which has decided advantages from the standpoint of the individual, as explained in our booklet, "*Concerning Trusts and Wills*," mailed on request.

During the coming year, New England will celebrate her 300th birthday. Visit the old historic shrines—and make this Company's office your banking headquarters while here.

OLD COLONY TRUST COMPANY
BOSTON

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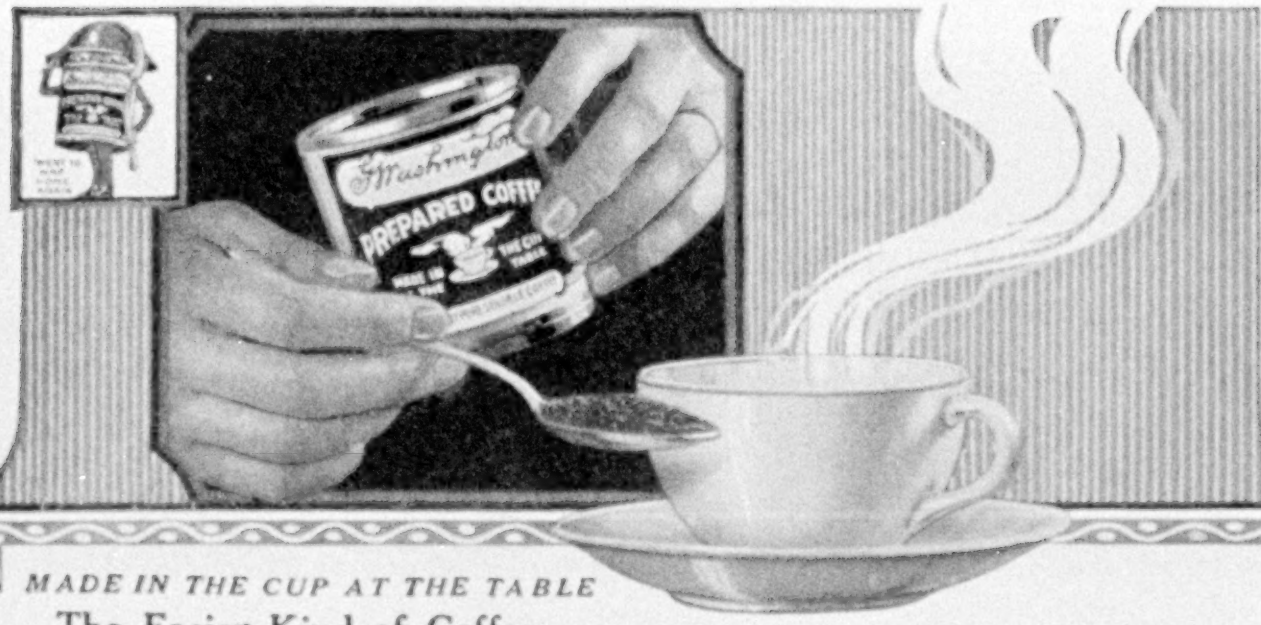

MADE IN THE CUP AT THE TABLE

The Easier Kind of Coffee —No Coffee Pot Needed

G. Washington's Coffee dissolves instantly in hot or cold water. Absolutely pure, delicious coffee always. Each cup to order.

All the preparing scientifically and perfectly done by Mr. Washington's refining process—which eliminates the woody fibre, chaff and waste.

Send 10c for Special Trial Size. Recipe Booklet Free.

G. Washington Sales Co., Inc.,
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G. Washington's COFFEE

Originated by Mr. Washington in 1909

M-20-9

Fine Lawns Kept Fine

Cutting large plots of grass with hand mowers is a tedious, expensive job. Labor is scarce and its cost is high.

If you are encountering difficulties in securing labor—if the cost of keeping your lawn in good condition is becoming excessive the Ideal Power Lawn Mower will solve your problems.

Being a power mower and roller in one, the Ideal permits economical *year round care.* Cuts from four to five acres of grass per day and is used with great success on private estates, public parks, cemeteries, golf courses, etc.

The Ideal is simple and trouble-proof. Any one can operate it. Sold on a guarantee of positive satisfaction. Write for literature and details, also for name of our nearest dealer.

Ideal Power Lawn Mower Co.
422 Kalamazoo St.
Lansing, Mich.

"Does the work of 5 Hand Mowers"

Sani-Flush

TRADE MARK REG. U. S. PATENT OFFICE

Cleans Closet Bowls Without Scouring

Cleans Closet Bowls Easily

IT IS no longer hard work to keep the toilet bowl spotlessly white and absolutely odorless. *Sani-Flush* does it for you.

Just sprinkle *Sani-Flush* into the bowl according to directions —the cleaning is done promptly, thoroughly, and efficiently and with scarcely any effort on your part.

The Hygienic Products Co.
325 Walnut Ave., Canton, Ohio

Canadian Agents: Harold F. Ritchie & Co., Ltd., Toronto

Sani-Flush is sold at grocery, drug, hardware, plumbing, and housefurnishing stores. If you cannot buy it locally at once, send us 25c in coin or stamps for a full-size can postpaid. (Can, price, 35c; foreign price, 50c.)

Dental Science

Has Now Found a Film Combatant

All Statements Approved by High Dental Authorities

A New Way to Save Teeth

Millions of teeth are being cleaned in a new way. Able authorities have tested and approved it. And leading dentists all over America are now urging its adoption.

The great tooth wrecker is a slimy film. It causes most tooth troubles. It clings to teeth, enters crevices, and stays. Ordinary brushing methods do not end it. So that film, despite your brushing, may do a ceaseless damage.

That film is what discolors—not the teeth. It is the basis of tartar. It holds food substance which ferments and forms acid. It holds the acid in contact with the teeth to cause decay.

Millions of germs breed in it. They, with tartar, are the chief cause of pyorrhea—now a common trouble.

Active Pepsin Now Applied

Dental science, after years of searching, has found a way to combat that film. Its efficiency has been proved beyond all question. Now the method is embodied in a dentifrice called Pepsodent, and at least a million people have adopted it already.

Pepsodent is based on pepsin, the digestant of albumin. The film is albuminous matter. The object of Pepsodent is to dissolve it, then to day by day combat it.

Pepsin long seemed impossible. It must be activated, and the usual agent is an acid harmful to the teeth. But science has discovered a harmless activating method, and thus opened a new dental era.

The Results Are Apparent

The results are quick and apparent. They can be seen and felt. A test is a revelation. So we send a 10-Day Tube to all who ask and let results convince them.

Make this test and you will know what clean teeth mean. There are few things more important.

Accept This Ten-Day Test

Send the coupon for a 10-Day Tube. Then note how clean the teeth feel after using. Mark the absence of the slimy film. See how teeth whiten as the fixed film disappears. This simple test will tell you what is best for you and yours.

Pepsodent PAT. OFF. REG. U. S.

The New-Day Dentifrice

A pepsin tooth paste which conforms in every way with modern dental requirements. Druggists everywhere are supplied with large tubes

291

Ten-Day Tube Free

THE PEPSODENT COMPANY,
Dept. 91, 1104 S. Wabash Ave., Chicago, Ill.
Mail 10-Day Tube of Pepsodent to

Name .....

Address .....

SPENCERIAN

PERSONAL

Steel Pens

Spencerian Pens are today what they have been all these years—*the best pens made.* The finest pen steel, a perfect writing point and extra long life make them so. That fascinating book, "What Your Handwriting Reveals", and 10 sample pens, different patterns, sent on receipt of 10c.

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Fine Medium
Stub and
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Address .....

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for membership in the Society

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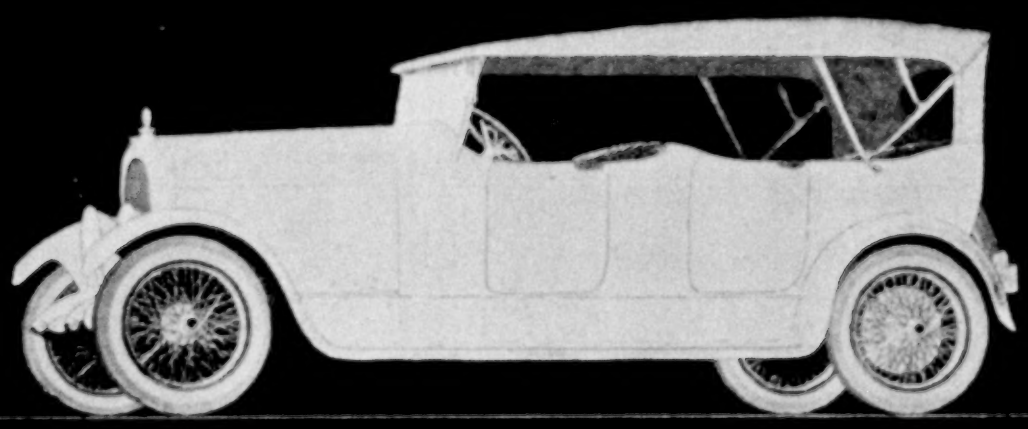
3-20 *Name and Address of Nominating Member*

MARMON 34

A motor car built to a new degree of accuracy — so smooth in operation, so immune to trouble and wear as to be an entirely new experience for the motoring world. A motor car that truly reflects the great lessons we learned in building aircraft engines for the government — *that* is the new series Marmon 34 with the High Efficiency Motor.

NORDYKE & MARMON COMPANY
Established 1851 :: INDIANAPOLIS



THE Detroit ELECTRIC

The Car Desired

To every one, we think, the fine electric is the desired car.

Perhaps it is because in grace of line, beauty of finish, and artistry of interior fittings the electric is unequaled.

Perhaps it is the superior cleanliness, ease of operation, and safety of the electric.

Or perhaps it is that while some type of gas car is within reach of everybody, the fine electric is essentially the car of the discriminating minority.

This year's Detroit Electric is the supreme achievement of years of dominance. Every lover of a fine car should see it.

DETROIT ELECTRIC CAR COMPANY
DETROIT MICHIGAN

The electric was the pioneer enclosed car—and it is still the best

The Purity Cross Mark

Purity Cross

CHICKEN A LA KING

Plump breasts of chicken garnished with fresh mushrooms, and a dash of bright red pimentos—and over the whole, pure, rich cream sauce—all blended by our master chef—*that* is appetizing, delicious Purity Cross Chicken a la King!

Try it on Toast

ALSO—PURITY CROSS Welsh Rarebit, Creamed Spaghetti au Gratin, Creamed Finnan Haddie, Lobster Newburg and Chop Suey. Also Meat Delicacies in tins. Sold by best grocers and delicatessens—in two size tins—ready for your instant convenience.

Special Get-Acquainted Assortment Offer

If your dealer hasn't Purity Cross Delicacies—send us his name and $2.00—and receive an assortment—one each of the above six, prepaid. Booklet free.

PURITY CROSS
MODEL KITCHEN
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Sparrows the Bolsheviki Bird

Get rid of them by using a Pat. Crescent Trap. The only Parcel Post Trap we know of. Price, $5.00 and Post Charges; weight, 9 Lbs. Free circular.

Encourage Industrious Birds

Houses for Wren, Bluebird, and Robin. Our famous 3 Bird-Houses for $3.50, weight, 10 Lbs.

CRESCENT CO.
"Birdville"
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10 Buys ¢100

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NO PASTE NEEDED

Use them to mount all kodak pictures, post cards, clippings in albums

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The Human Side of Service

More than a year has passed since the signing of the Armistice, yet all the world still feels the effects of the War. The Telephone Company is no exception.

More than 20,000 Bell telephone employees went to war; some of them never returned. For eighteen months we were shut off from practically all supplies.

War's demands took our employees and our materials, at the same time requiring increased service.

Some districts suffered. In many places the old, high standard of service has been restored.

In every place efforts at restoration are unremitting. The loyalty of employees who have staid at their tasks and the fine spirit of new employees deserve public appreciation.

They have worked at a disadvantage but they have never faltered, for they know their importance to both the commercial and social life of the country.

These two hundred thousand workers are just as human as the rest of us. They respond to kindly, considerate treatment and are worthy of adequate remuneration. And the reward should always be in keeping with the service desired.

AMERICAN TELEPHONE AND TELEGRAPH COMPANY
AND ASSOCIATED COMPANIES

One Policy *One System* *Universal Service*

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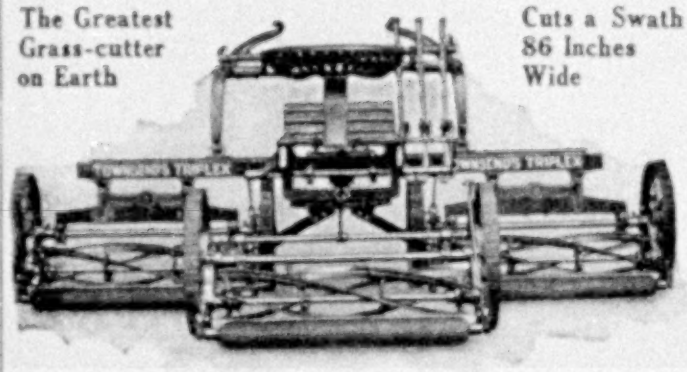
TOWNSEND'S TRIPLEX

The Greatest Grass-cutter on Earth

Cuts a Swath 86 Inches Wide



Floats Over the Uneven Ground as a Ship Rides the Waves

One mower may be climbing a knoll, the second skimming a level, while the third pares a hollow. Drawn by one horse and operated by one man, the TRIPLEX will mow more lawn in a day than the best motor mower ever made; cut it better and at a fraction of the cost.

Drawn by one horse and operated by one man, it will mow more lawn in a day than any three ordinary horse-drawn mowers with three horses and three men.

Does not smash the grass to earth and plaster it in the mud in springtime, neither does it crush the life out of the grass between hot rollers and hard, hot ground in summer, as does the motor mower.

The public is warned not to purchase mowers infringing the Townsend Patent, No. 1,209,519, December 19th, 1916.

Write for catalog illustrating all types of Lawn Mowers.

S. P. TOWNSEND & CO.

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GOLFLEX

For Spring Street Wear

Choose a dress of GOLFLEX worsted Jersey, designed with a smart simplicity, and tailored with masterly skill.

GOLFLEX suits, coats, and dresses are distinctive in fabric and fashioning, and are chosen by thoroughbred American women for all outdoor wear. See them at your favorite shop or write direct to the makers.

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The Utmost in Cigarettes
Plain End or Cork Tip

People of culture and refinement invariably PREFER Deities to any other cigarette

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Anargyros

Makers of the Highest Grade Turkish and Egyptian Cigarettes in the World

SERIES 20

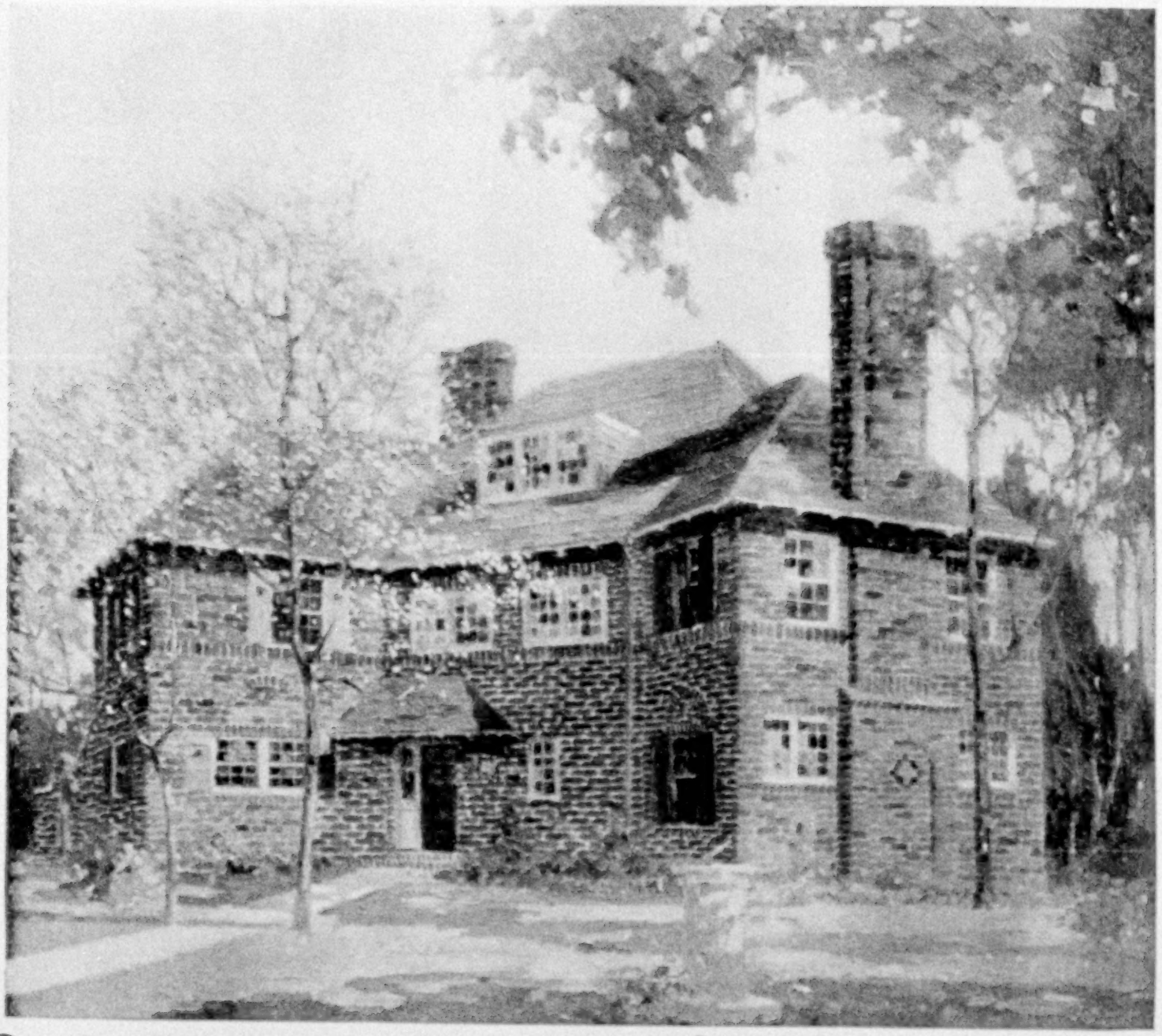
Studebaker

SPECIAL-SIX

THE mechanical excellence, ease of control and remarkable riding comfort of the SERIES 20 SPECIAL-SIX can only be appreciated when you sit behind the wheel and feel the responsiveness of its flexible motor to your slightest touch.

50 H. P. detachable-head motor; intermediate transmission; 119-inch wheelbase; five passenger capacity; cord tire equipment; outside and inside door handles; improved windshield with bullet-shaped cowl lamps; extension tonneau lamp.

Studebaker quality, dominant for sixty-eight years, is reflected in this SPECIAL-SIX.



Painting after House by Frank Chouteau Brown, Architect

The Structural and Artistic Values of the HOUSE *of* BRICK

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—it Pays

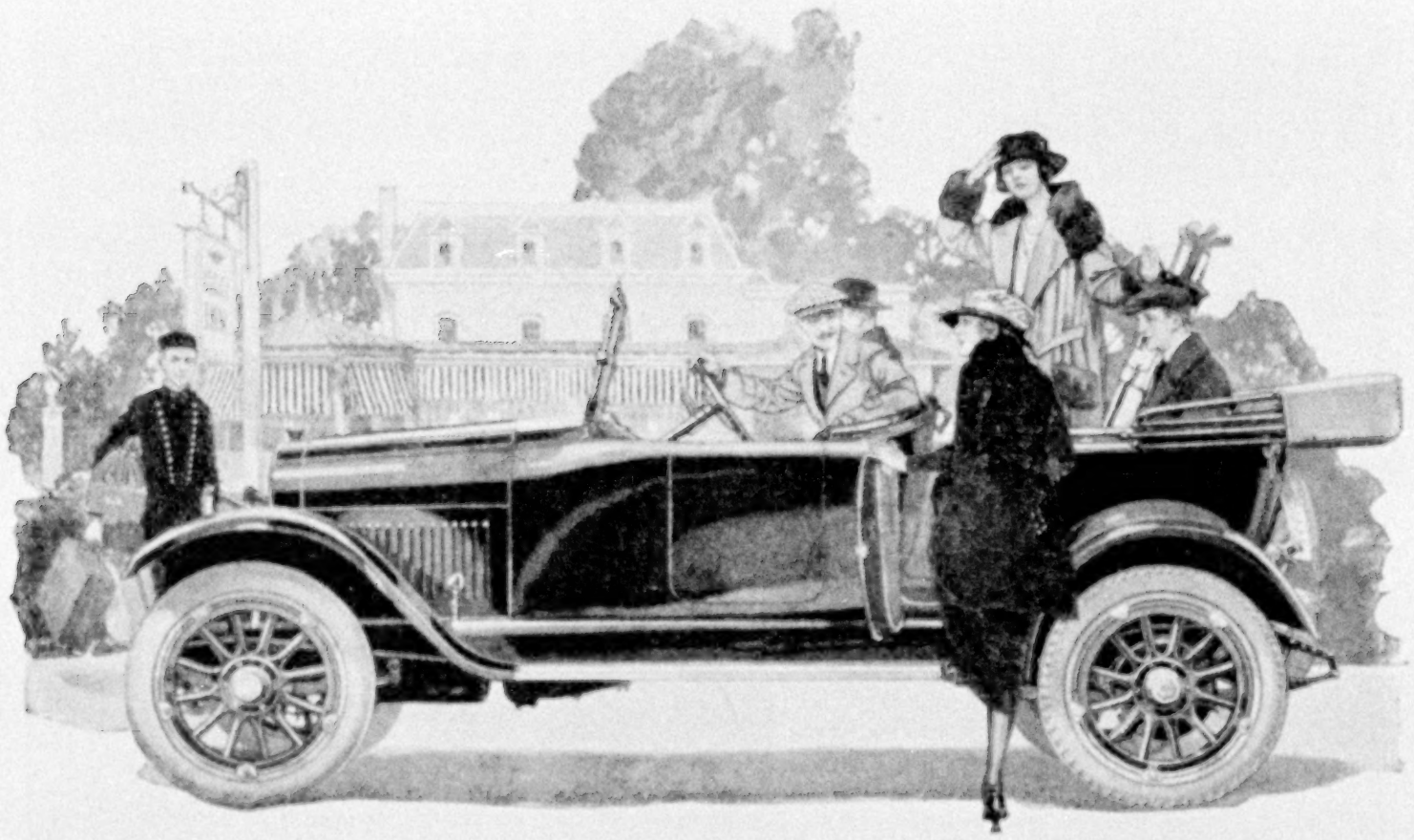
"The Story of Brick"

An artistic booklet with attractive illustrations and useful information for all who intend to build. The Romance of Brick, Extravagance of Cheapness, Comparative Costs, How to Finance the Building of a Home, are a few of the subjects treated. Your copy is awaiting your request. Send today.

OTHER building materials have their merits and make their appeal, but looking at the building problem on all sides, no other material approaches Face Brick in the structural and artistic values it offers—permanence, comfort, safety from fire, economy, and beauty. The slight difference in first cost over less durable materials is soon wiped out by the many savings that go with a Face Brick house. You will find this subject fully discussed in "The Story of Brick." Send for it now.

The American Face Brick Association

1137 Westminster Building, Chicago



A MAXWELL
reveals the Wisdom of Light Weight

A MAXWELL car carries the same average passenger weight over the same roads and at the same speed as other cars, regardless of their weight and price.

To do this task at *extremely low cost* is the particular mission of the Maxwell.

Therefore it was necessary to eliminate every pound of superfluous weight, for each added pound to carry around meant added expense.

How to reduce the weight without reducing the strength thus became the vital engineering problem in this car.

To maintain the required strength without increasing weight necessitated the use of the best materials. The great science of metallurgy supplied the answer. Such metals are obviously the quality metals; and a Maxwell car contains them throughout.

Maxwell

More miles per gallon
More miles on tires

An analysis will show that *pound for pound the metals that go into a Maxwell car are comparable with the metals in the highest priced cars in the world.*

That is the underlying reason why Maxwell cars have given such rare accounts of themselves in every latitude and clime and have responded so well to every task to which they have been committed.

They hold the greatest efficiency-economy record a car has ever made—22,020 miles at an average speed of 25 miles an hour, with an average of 22 miles to the gallon of gasoline.

And during this test the engine never once stopped, day or night. It was continuous, low cost, highly reliable mileage.

Such steels, such certainty of performance, such saving, have won many friends for Maxwell.

MAXWELL MOTOR CO., INC., DETROIT, MICH.

MAXWELL MOTOR CO. OF CANADA, LTD., WINDSOR, ONTARIO

MAXWELL MOTOR CO., INC., EXPORT DIVISION, 1808 BROADWAY, NEW YORK CITY

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SUSTAINING THE MARK OF INDUSTRIAL SUPREMACY

THOUSANDS of world-wide industries will tell you they are served by Fairbanks-Morse. To them, this service from an institution with broad manufacturing and distributing resources has proven by experience to be dependable, efficient and forward-looking.

We see this service through the eyes of many thousands of Fairbanks-Morse employes, each striving to uphold the mark of industrial supremacy, reflected in the Quality Seal of this organization. To these employes has been granted the vision to produce constantly improved products in order that Fairbanks-Morse may better serve the world's industrial and agricultural needs.

In this way does every Fairbanks-Morse employe help make good the institutional promise of which this mark is the symbol.

Thousands of skilled employes working in eight factories covering hundreds of acres produce Fairbanks-Morse oil engines—pumps—electric motors and generators—Fairbanks Scales—railway appliances—farm machinery, such as "Z" engines, lighting plants, water systems and windmills.

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World-wide distribution through our own branches and representatives

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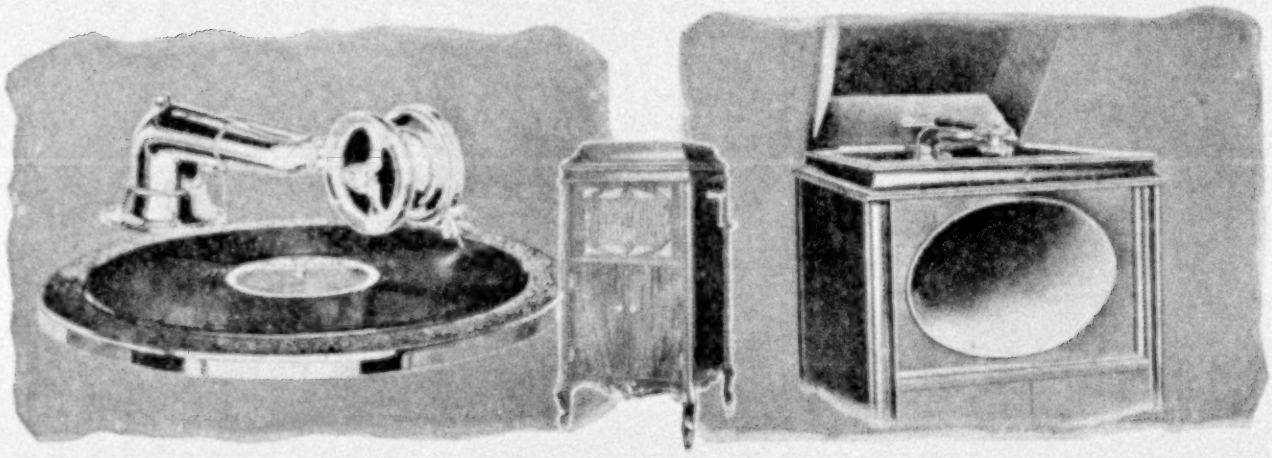
Brunswick

PHONOGRAPHS AND RECORDS



The Ultona *The Tone Amplifier*

Two Great Advancements in Phonographic Art

The nation-wide success of Brunswick Phonographs is due largely to the Ultona and the Brunswick Tone Amplifier—two features of the Brunswick Method of Reproduction.

These came out at a time when betterments seemed impossible. The Ultona distinguished The Brunswick as an all-record phonograph—an idea now practically universal.

But no one can duplicate the Ultona, for it is a Brunswick patent. At the turn of a hand it presents to each make of record the proper diaphragm, the proper needle. It brings out tones hitherto lost Each record is heard at its best.

The Brunswick Tone Amplifier brought better tone. It is made entirely of wood. We abandoned the old-time idea of a metal throat. Thus, by adopting the violin principle, tone waves are given proper acoustic staging.

Brunswick tone brings fullness, richness, clarity. We avoid harsh and strident notes.

There is only one way to fully appreciate The Brunswick. That is to hear it and then hear others. Your own ear will immediately appreciate Brunswick superiority. This is the unfailing test which has put thousands and thousands of Brunswicks in homes the nation over.

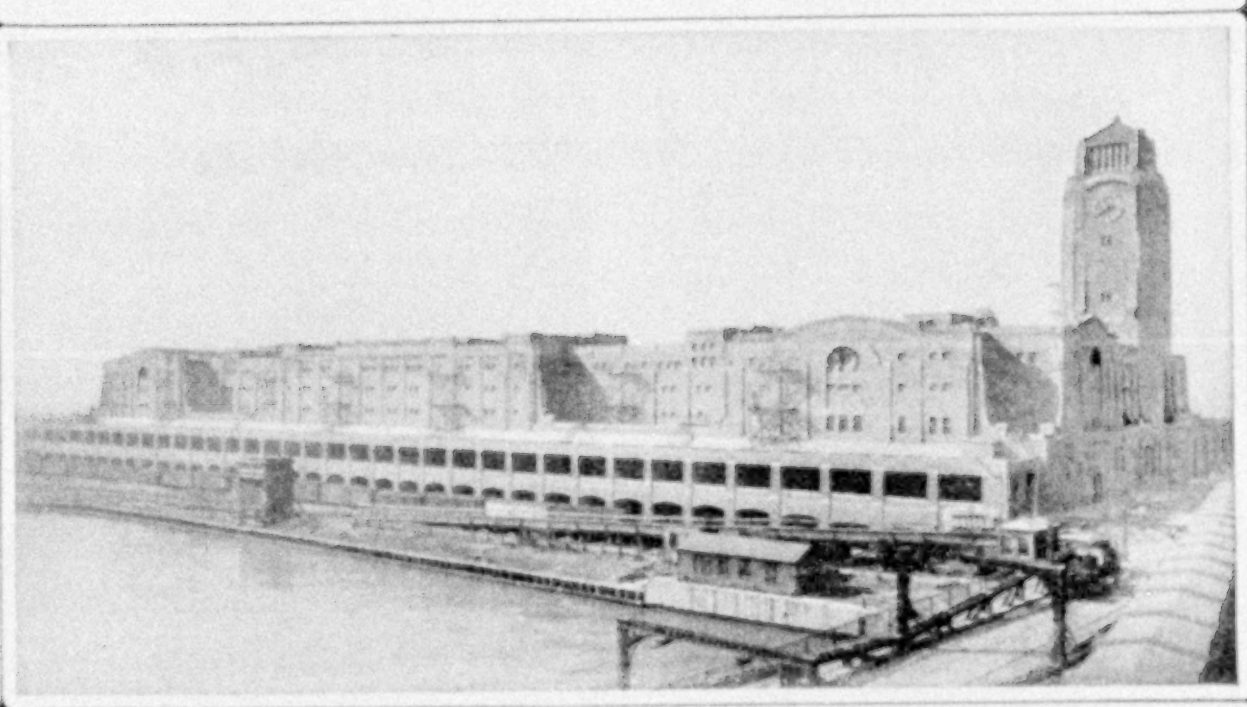
THE BRUNSWICK-BALKE-COLLENDER COMPANY
General Offices: 623-633 South Wabash Ave., Chicago

Branch Houses in Principal Cities of United States, Mexico and Canada
Canadian Distributors: Musical Merchandise Sales Co., 819 Yonge Street, Toronto

Now a Triumph in Records

The time has come after years of preparation when Brunswick Records are now on sale. Again we create new standards. We offer interpretations by noted directors. Thus we unite the talent of the artist with the genius of the composer. It brings the final link in authoritative renditions. Again, let us suggest that your own ear decide upon the merit of Brunswick Records.

XUM



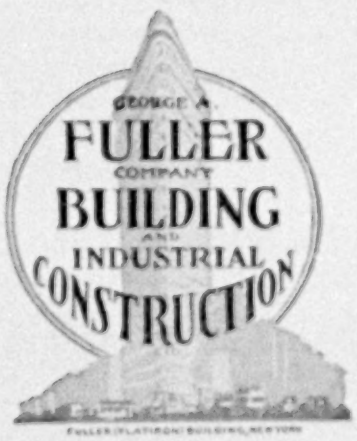
The Famous Pennsylvania Railroad Freight Terminal at Chicago

Fuller-Built Landmarks

THE successful building of a great structure like this mammoth Freight Terminal completed in record time for the Pennsylvania Railroad demands the coordinated effort of the strongest and best organized constructors obtainable.

Hundreds of millions of dollars worth of splendid structures throughout the principal cities of the United States and Canada bear ample testimony that the Fuller name on a building under construction is evidence that the job is being handled with fidelity and economy.

Our nation-wide organization with its exceptional resources for efficient performance is at your service.



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PAINTED FOR FATHER TIME BY HUGH RANKIN

EVEN prehistoric man felt the value of time.

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A crude device—yet it brought a vague new sense of control—a foretaste of the satisfaction modern man finds in working to schedule.

Down through the ages, man's realization of the value of Time has steadily grown. The world's time-meters have developed amazingly.

But to the creative instinct of this low-browed troglodyte we owe man's first upward step toward the marvelous time-pieces of today—

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EVEN a casual glance at the accompanying illustration impresses one with the dignity, grace, and appropriateness of this memorial. The delicately protrayed figure and bronze cinerary urn add to its uniqueness.

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Order Your Bulbs Now, so as to have them to plant when you begin making your garden.

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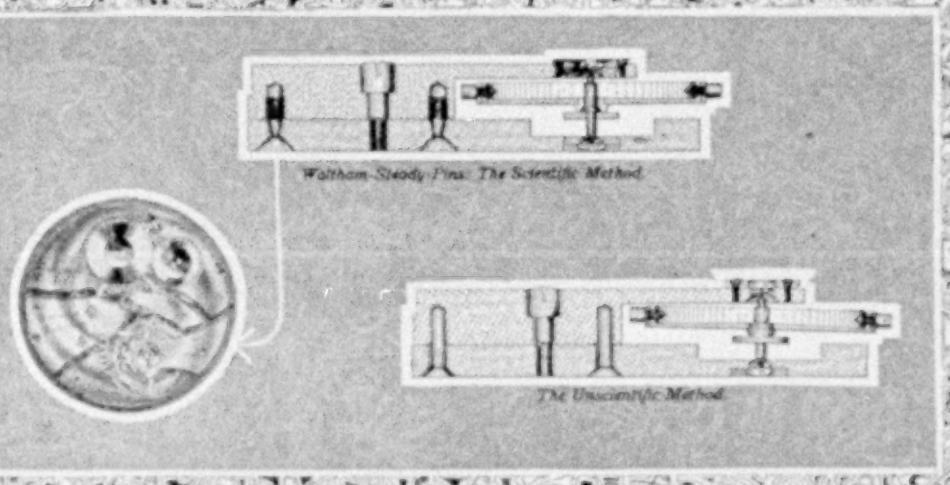

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Waltham Scientific "Steady Pins" that Mean So Much to You in Time-keeping Accuracy

Pendant and Bow Patented

Waltham Colonial A
Extremely thin at no sacrifice of accuracy
Maximus movement
21 jewels
Riverside movement
19 jewels
$200 to $325 or more
depending upon the case

TO the marvels of Waltham machinery, to the mechanical superiorities of fundamental units in the Waltham Watch, we are going to add another chapter.

We are going to prove by illustrated example that Waltham *is* the watch that placed America first in watchmaking, that its mechanism *does* contain scientific superiorities which are the reasons for Waltham leadership—

Tiny units involving years of study, of invention that are related to Waltham precision, time-keeping and durability.

A reliable watch demands a perfectly true and upright "train" and "balance." By 'true' and 'upright' we mean, that the lower bearing, or jewel, must be absolutely in line with the corresponding upper bearing or jewel—

Because, if the upper or lower plates are not positively located, one to the other, the balance or train is forced out of correct position, creating excess friction, disturbing original adjustment, and causing erratic performance in time-keeping.

To locate, positively and permanently, each plate upon plate in perfect alignment, Waltham horological genius created a scientific "steady pin" (enlarged illustration above), which is so tapered to enter and leave its aperture with extreme ease, yet positively locates the plates and jeweled bearings in their relation one to the other.

All other manufacturers use a *straight* "steady pin." If they make it small enough to enter and leave freely its corresponding aperture, the lower illustration plainly shows what then happens to an important function of your watch. Its wheels become *out of upright*, and your watch an uncertain timepiece.

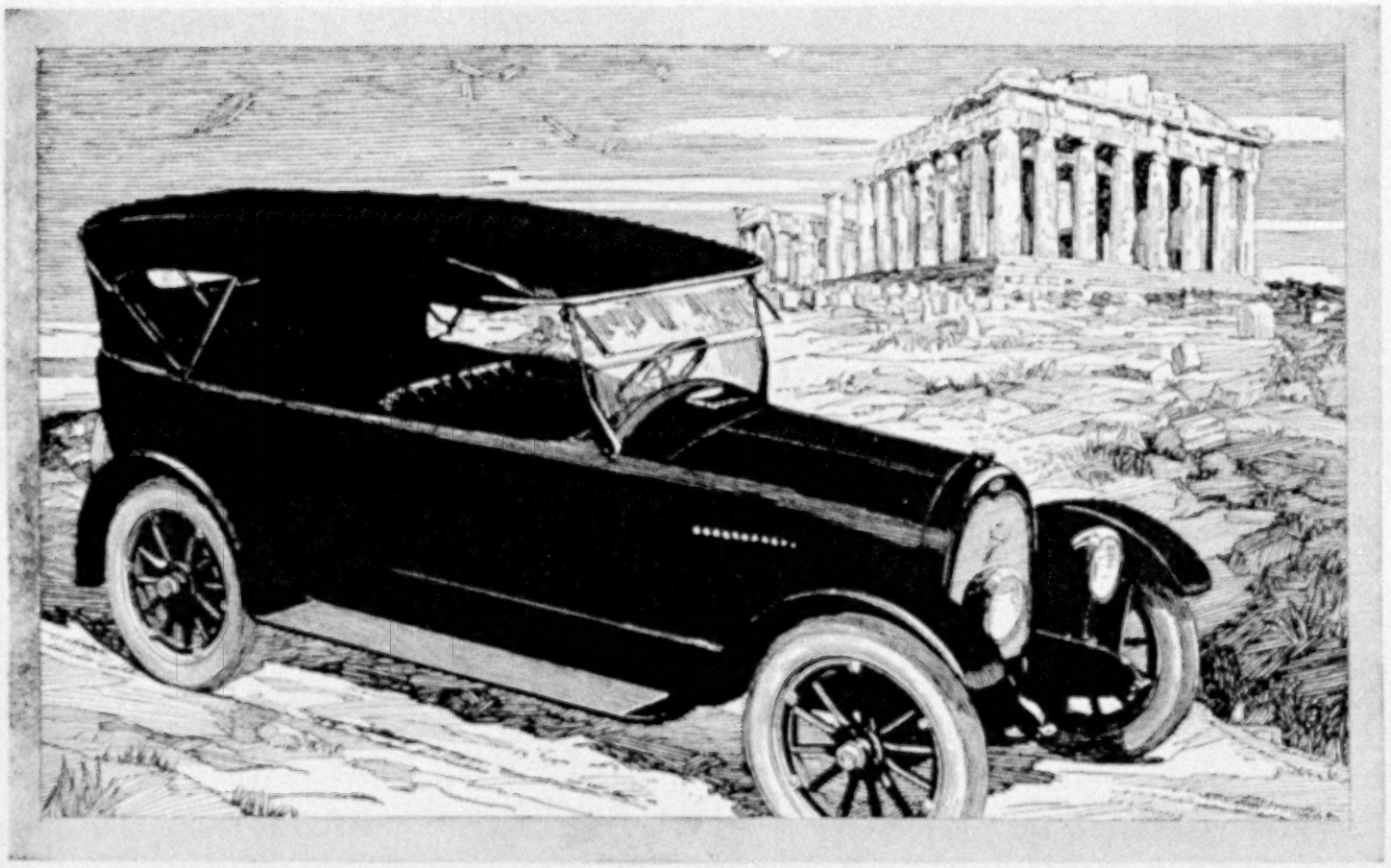
But should the *straight* "steady pin" be made to fit tight enough in its jewel-bearing location (as shown in the lower illustration), the watchmaker when repairing your watch would be liable to break the balance pivots, which means a further readjustment and extra expense to you.

The Waltham scientific *tapered* "steady pin" is one more reason that your selection of a watch should be a Waltham.

This story is continued in a beautiful booklet in which you will find a liberal watch education. Sent free upon request. Waltham Watch Company, Waltham, Mass.

WALTHAM

THE WORLD'S WATCH OVER TIME



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The works of man that endure are all alike and vitalized by the same spark. That spark is the striving for an ideal perfection that forgets immediate profit.

When the Apperson Brothers built with their own hands the first mechanically successful automobile, their goal was achievement of an ideal perfection.

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APPERSON

The Eight with Eighty Less Parts

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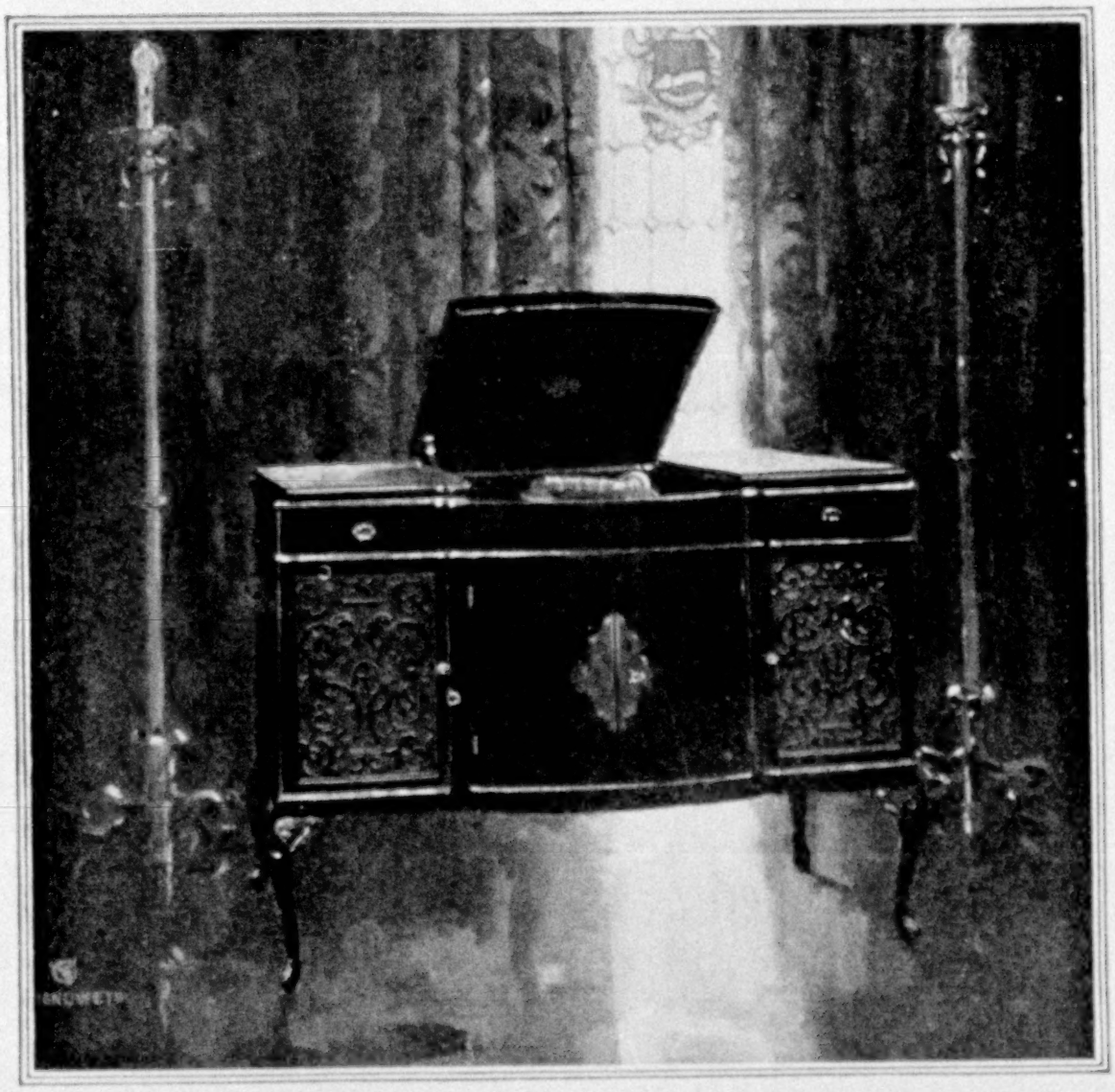

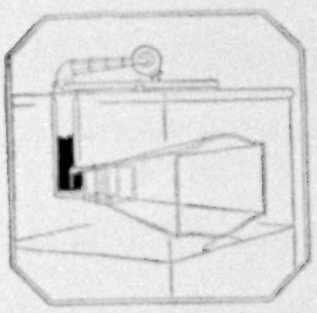

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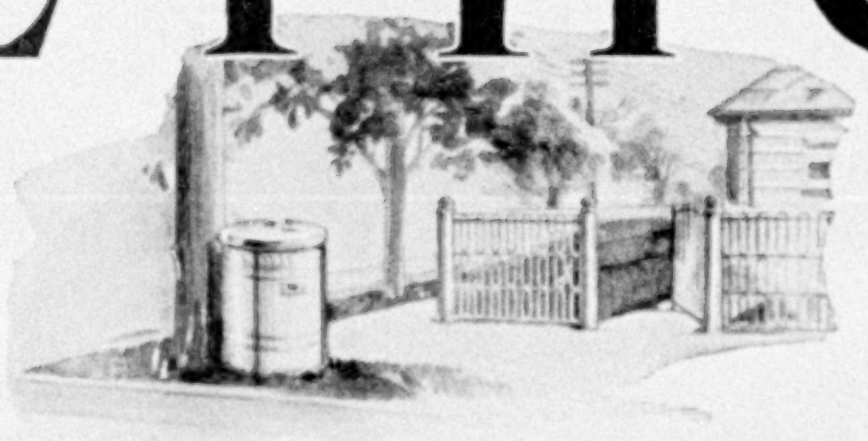

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Zinc

"Mention The Geographic—It identifies you"

Is carbon choking your motor?

Do you have to shift to "second" on hills and retard your spark to stop "carbon knocks"?

CARBON deposit is a natural result of what goes on inside the gasoline motor. Excessive carbon is caused chiefly by four things:

1—A too-rich carburetor mixture
2—Backpressure, due to clogged muffler
3—Unsuitable, inferior oil
4—Worn or broken piston rings

Carbon clogs your cylinders, overheats your motor, causing "carbon knocks", fouls spark plugs, gums up piston rings and pits exhaust valves, causing leaky compression.

You can help prevent carbon forming by always getting that 13 parts air to 1 part gasoline mixture. Here's how—

With the motor warmed up and idling, open the G-Piel Muffler Cut-Out and turn down the adjusting screw until you hear the motor begin to slow down. Then turn the other way *very slowly* until you again hear the maximum speed.

On the other hand, the trouble you are experiencing may be caused by a caked, clogged muffler.

To find out about *your* muffler, simply test the motor *with* the muffler and *without* it. There is nothing like a G-Piel Cut-Out for easy motor testing.

And when blowing out the motor with kerosene, wood alcohol or other "carbon remover" be sure you open the G-Piel, as this keeps the loosened deposit from getting into the muffler.

Every enthusiastic motorist enjoys the sharp, clear bark of a powerful, sweet-running motor. A hot spark in every cylinder, valves opening wide and seating tight, just the right mixture from carburetor, exhaust gases scavenging freely through the G-Piel Cut-Out.

Select the right size cut-out for your car from the G-Piel chart at your dealer's. It will save its cost many times in a single season.

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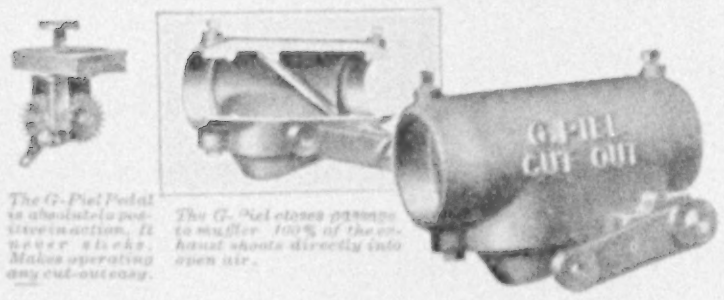

The G-Piel Pedal is absolutely positive in action. It never sticks. Makes operating any cut-out easy.

The G-Piel closes passage to muffler 100% of the exhaust shoots directly into open air.

G-Piel Muffler Cut-Out

Tells the motor's secrets

How the Biggest Thing in Life Almost Passed Me By

"That night at dinner my husband's two friends talked almost entirely to him—not to me. I was left out.

"The things I said did not seem to hold their attention. Perhaps I lacked self-confidence at first. I know that I was humiliated and angry later on.

"And it was not the first time that this had happened. Even when with women I had noticed it—how they drifted away from me, and clustered around others who seemed to have a charm that I lacked.

"That night, as I sat neglected at the head of my own table, I began wondering what was wrong. Listening to the brilliant conversation of these two men and my husband, I realized all at once that something was lacking in me. My viewpoint was too narrow—my interests too few. I had been tied down too much to my household and children. *I had never gained the broad mental background that gave poise and charm to the very people I most admired.* The biggest thing in life had almost passed me by."

We have all met men and women whose rich and varied mental background gives them their vivid imagination and personality—gives them their influence over others—makes them always listened to. It is to gain this wide knowledge easily and delightfully that leaders in every branch of American life have joined the Mentor Association—men and women like Judge Gary, Mary Roberts Rinehart, Mrs. Felix Warburg, Robert H. Ingersoll, and the Reverend Ernest M. Stires of New York.

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In your spare moments through the Mentor Association you can begin to build up that deep and varied mental background which brings poise, charm, and influence over others. Apply for membership today. *Send no money.* Read the coupon below—clip it out—and mail it to us with your name and address.

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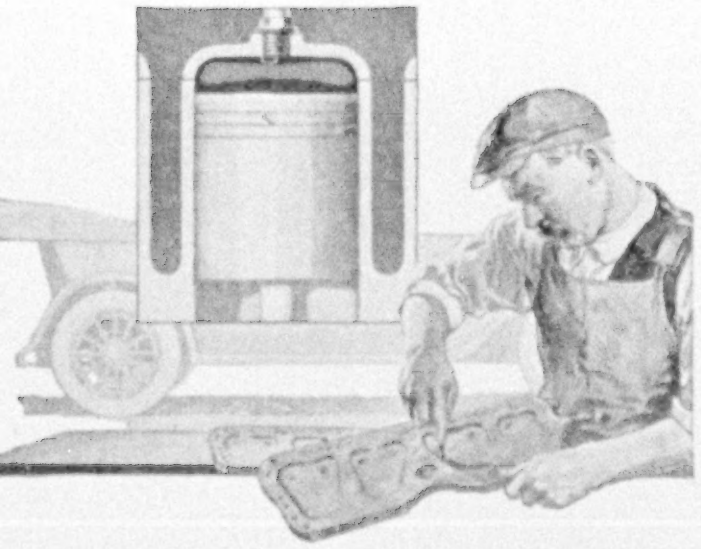

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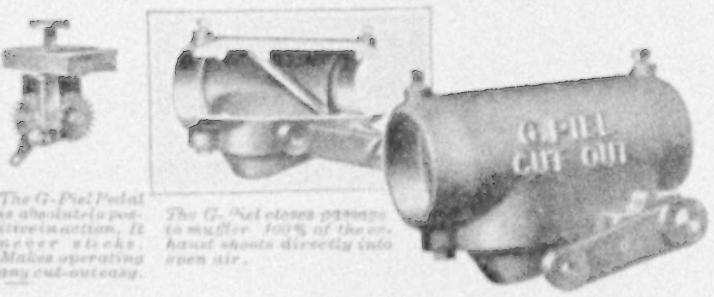

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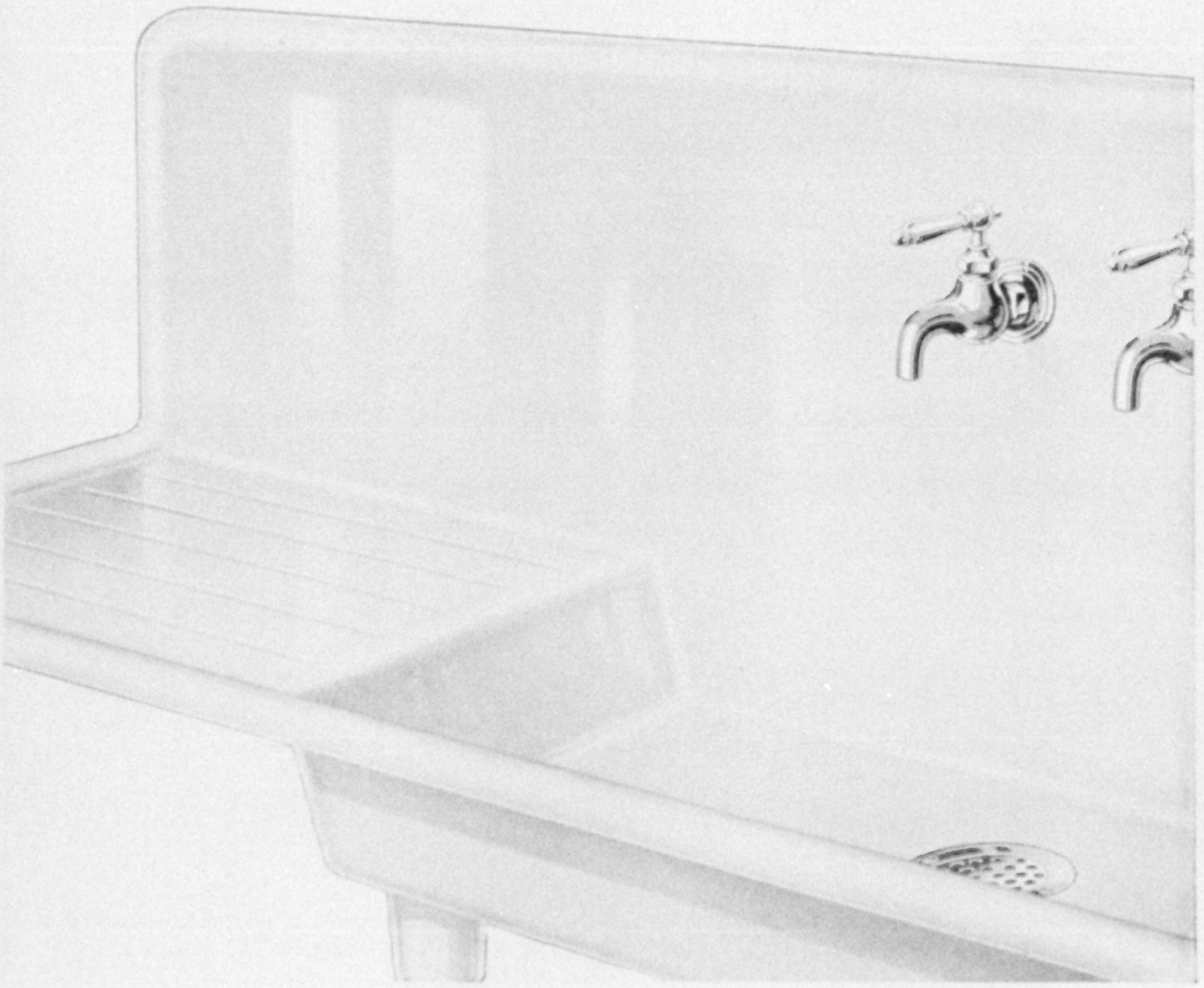
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